THE DEVELOPING WORLD IS POORER THAN WE THOUGHT, BUT NO LESS SUCCESSFUL IN THE FIGHT AGAINST POVERTY*

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A new data set on national poverty lines is combined with new price data and almost 700 household surveys to estimate absolute poverty measures for the developing world. We find that 25% of the population lived in poverty in 2005, as judged by what "poverty" typically means in the world's poorest countries. This is higher than past estimates. Substantial overall progress is still indicated—the corresponding poverty rate was 52% in 1981—but progress was very uneven across regions. The trends over time and regional profile are robust to various changes in methodology, though precise counts are more sensitive.

I. INTRODUCTION

When the extent of poverty in a given country is assessed, a common (real) poverty line is typically used for all citizens within that country, such that two people with the same standard of living—measured in terms of current purchasing power over commodities—are treated the same way in that both are either poor or not poor. Similarly, for the purpose of measuring poverty in the world as a whole, a common standard is typically applied across countries. This assumes that a person's poverty status depends on his or her own command over commodities, and not on where he or she lives independently of that.[1]

In choosing a poverty line for a given country one naturally looks for a line that is considered appropriate for that country, while acknowledging that rich countries tend to have higher real

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1. For further discussion of this assumption, see Ravallion (2008b) and Ravallion and Chen (2010).

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poverty lines than poor ones. (Goods that are luxuries in rural India, say, are considered absolute necessities in the United States.) There must, however, be some lower bound, because the cost of a nutritionally adequate diet (and even of social needs) cannot fall to zero. Focusing on that lower bound for the purpose of measuring poverty in the world as a whole gives the resulting poverty measure a salience in characterizing "extreme poverty," though higher lines are also needed to obtain a complete picture of the distribution of levels of living.

This reasoning led Ravallion, Datt, and van de Walle (RDV) (1991)—in background research for the 1990 *World Development Report* (World Bank 1990)—to propose two international lines: the lower one was the predicted line for the poorest country and the higher one was a more typical line amongst low-income countries. The latter became known as the "$1-a-day" line. In 2004, about one in five people in the developing world—close to one billion people—were poor by this standard (Chen and Ravallion 2007).

This paper reports on the most extensive revision yet of the World Bank's estimates of poverty measures for the developing world.[2] In the light of a great deal of new data, the paper estimates the global poverty count for 2005 and updates all past estimates back to 1981.

New data from three sources make the need for this revision compelling. The first is the 2005 International Comparison Program (ICP). The price surveys done by the ICP have been the main data source for estimating PPPs, which serve the important role of locating the residents of each country in the "global" distribution. Prior to the present paper, our most recent global poverty measures had been anchored to the 1993 round of the ICP. A better funded round of the ICP in 2005, managed by the World Bank, took considerable effort to improve the price surveys, including developing clearer product descriptions. A concern about the 1993 and prior ICP rounds was a lack of clear standards in defining internationally comparable commodities. This is a serious concern in comparing the cost of living between poor countries and rich ones, given that there is likely to be an economic gradient in the quality of commodities consumed and (relatively homogeneous) "name brands" are less common in poor countries. Without strict standards in defining the products to be priced, there is a risk

2. By the "developing world" we mean all low- and middle-income countries—essentially the Part 2 member countries of the World Bank.

that one will underestimate the cost of living in poor countries by confusing quality differences with price differences. The new ICP data imply some dramatic revisions to past estimates, consistent with the view that the old ICP data had underestimated the cost-of-living in poor countries (World Bank 2008b).

The second data source is a new compilation of poverty lines. The original "$1-a-day" line was based on a compilation of national lines for only 22 developing countries, mostly from academic studies in the 1980s. Although this was the best that could be done at the time, the sample was hardly representative of developing countries even in the 1980s. Since then, national poverty lines have been developed for many other countries. Based on a new compilation of national lines for 75 developing countries provided by Ravallion, Chen, and Sangraula (2009), this paper implements updated international poverty lines, in the spirit of the aim of the original $1-a-day line, namely to measure global poverty by the standards of the poorest countries.

The third data source is the large number of new household surveys now available. We draw on 675 surveys, spanning 115 countries and 1979–2006. (In contrast, the original RDV estimates used 22 surveys, one per country; Chen and Ravallion [2004] used 450 surveys.) Each of our international poverty lines at PPP is converted to local currencies in 2005 and then is converted to the prices prevailing at the time of the relevant household survey using the best available Consumer Price Index (CPI). (Equivalently, the survey data on household consumption or income for the survey year are expressed in the prices of the ICP base year, and then converted to PPP dollars.) Then the poverty rate is calculated from that survey. All intertemporal comparisons are real, as assessed using the country-specific CPI. We make estimates at three-year intervals over the years 1981–2005. Interpolation/extrapolation methods are used to line up the survey-based estimates with these reference years, including 2005. We also present a new method of mixing survey data with national accounts (NAS) data to try to reduce survey-comparability problems. For this purpose, we treat the national accounts data on consumption as the data for predicting a Bayesian prior for the survey mean and the actual survey as the new information. Under log-normality with a common variance, the mixed posterior estimator is the geometric mean of the survey mean and its predicted value based on the NAS.

These new data call for an upward revision of our past estimates of the extent of poverty in the world, judged by the

standards of the world's poorest countries. The new PPPs imply that the cost of living in poor countries is higher than was thought, implying greater poverty at any given poverty line. Working against this effect, the new PPPs also imply a downward revision of the international value of the national poverty lines in the poorest countries. On top of this, we also find that an upward revision to the national poverty lines is called for, largely reflecting sample biases in the original data set used by RDV. The balance of these data revisions implies a higher count of global poverty by the standards of the world's poorest countries. However, we find that the poverty profile across regions and the overall rate of progress against absolute poverty are fairly robust to these changes, and to other variations on our methodology.

II. Purchasing Power Parity Exchange Rates

International economic comparisons have long recognized that market exchange rates are deceptive, given that some commodities are not traded internationally; these include services but also many goods, including some food staples. Furthermore, there is likely to be a systematic effect, stemming from the fact that low real wages in developing countries entail that nontraded goods tend to be relatively cheap. In the literature, this is known as the "Balassa–Samuelson effect" (Balassa 1964; Samuelson 1964), which is the most widely accepted theoretical explanation for an empirical finding known as the "Penn effect"—that richer countries tend to have higher price indices, as given by the ratios of their PPPs to the market exchange rate.[3] Thus GDP comparisons based on market exchange rates tend to understate the real incomes of developing countries. Similarly, market exchange rates overstate the extent of poverty in the world when judged relative to a given US$ poverty line. Global economic measurement, including poverty measurement, has relied instead on PPPs, which give conversion rates for a given currency with the aim of ensuring parity in terms of purchasing power over commodities, both internationally traded and nontraded. Here we only point to some salient features of the new PPPs relevant to measuring poverty in the developing world.[4] We focus on the PPP for

3. The term "Penn effect" stems from the Penn World Tables (Summers and Heston 1991).

4. Broader discussions of PPP methodology can be found in Ackland, Dowrick, and Freyens (2007), World Bank (2008b), Deaton and Heston (2010), and Ravallion (2010).

individual consumption, which we use later in constructing our global poverty measures.[5]

The 2005 ICP is the most complete and thorough assessment to date of how the cost of living varies across the world, with 146 countries participating.[6] The world was divided into six regions (Africa, Asia–Pacific, Commonwealth of Independent States, South America, Western Asia, and Eurosat–OECD) with different product lists for each. The ICP collected primary data on the prices for 600–1,000 (depending on the region) goods and services grouped under 155 "basic headings" corresponding to the expenditure categories in the national accounts; 110 of these relate to household consumption. The price surveys covered a large sample of outlets in each country and were done by the government statistics offices in each country, under supervision from regional and World Bank authorities.

The price surveys for the 2005 ICP were done on a more scientific basis than prior rounds. Following the recommendations of the Ryten Report (United Nations 1998), stricter standards were used in defining internationally comparable qualities of the goods. Region-specific detailed product lists and descriptions were developed, involving extensive collaboration amongst the countries and the relevant regional ICP offices. Not having these detailed product descriptions, it is likely that the 1993 ICP used lower qualities of goods in poor countries than would have been found in (say) the U.S. market.[7] This is consistent with the findings of Ravallion, Chen, and Sangraula (RCS) (2009) suggesting that a sizable underestimation of the 1993 PPP is implied by the 2005 data. Furthermore, the extent of this underestimation tends to be greater for poorer countries.

The regional PPP estimates were linked through a common set of global prices collected in 18 countries spanning the regions, giving what the ICP calls "ring comparisons." The design of these ring comparisons was also a marked improvement over past ICP rounds.[8]

5. This is the PPP for "individual consumption expenditure by households" in World Bank (2008b). It does not include imputed values of government services to households.

6. As compared to 117 in the 1993 ICP; the ICP started in 1968 with PPP estimates for just 10 countries, based on rather crude price surveys.

7. See Ahmad (2003) on the problems in the implementation of the 1993 ICP round.

8. The method of deriving the regional effects is described in Diewert (2008). Also see the discussion in Deaton and Heston (2010).

The World Bank uses a multilateral extension of Fisher price indices, known as the EKS method, rather than the Geary–Khamis (GK) method used by the Penn World Tables. The GK method overstates real incomes in poor countries (given that the international prices are quantity-weighted), imparting a downward bias to global poverty measures, as shown by Ackland, Dowrick, and Freyens (2007).[9] There were other differences with past ICP rounds, though they were less relevant to poverty measurement.[10]

Changes in data and methodology are known to confound PPP comparisons across benchmark years (Dalgaard and Sørensen 2002; World Bank 2008a). It can also be argued that poverty comparisons over time for a given country should respect domestic prices.[11] We follow standard practice in doing the PPP conversion only once, in 2005, for a given country; all estimates are then revised back in time consistently with the CPI for that country. We acknowledge, however, the national distributions formed this way may well lose purchasing power comparability as one goes further back in time from the ICP benchmark year.

Some dramatic revisions to past PPPs are implied by the 2005 ICP, not least for the two most populous developing countries, China and India—neither of which actually participated in the price surveys for the 1993 ICP.[12] The 1993 consumption PPP used for China (estimated from non-ICP sources) was 1.42 yuan to the US$ in 1993, whereas the new estimate based on the 2005 ICP is 3.46 yuan (4.09 if one excludes government consumption). The corresponding price index level (US$ = 100) went from 25% in 1993 to 52% in 2005. So the Penn effect is still evident, but it has declined markedly relative to past estimates, with a new PPP at about half the market exchange rate rather than one-fourth. Adjusting solely for the differential inflation rates in the United States and China, one would have expected the 2005 PPP

9. Though this problem can be fixed; see Iklé (1972). In the 2005 ICP, the Africa region chose to use Iklé's version of the GK method (African Development Bank 2007).

10. New methods for measuring government compensation and housing were used. Adjustments were also made for the lower average productivity of public sector workers in developing countries (lowering the imputed value of the services derived from public administration, education, and health).

11. Nuxoll (1994) argues that the real growth rates measured in domestic prices better reflect the trade-offs facing decision makers at country level, and thus have a firmer foundation in the economic theory of index numbers.

12. In India's case, the 1993 PPP was an extrapolation from the 1985 PPP based on CPIs, whereas in China's case the PPP was based on non-ICP sources and extrapolations using CPIs.

to be 1.80 yuan, not 3.46. Similarly, India's 1993 consumption PPP was Rs 7.0, whereas the 2005 PPP is Rs 16, and the price level index went from 23% to 35%. If one updated the 1993 PPP for inflation one would have obtained a 2005 PPP of Rs 11 rather than Rs 16.

Although there were many improvements in the 2005 ICP, the new PPPs still have some problems. Four concerns stand out in the present context. First, making the commodity bundles more comparable across countries (within a given region) invariably entails that some of the reference commodities are not typically consumed in certain countries, and prices are then drawn from untypical outlets such as specialist stores, probably at high prices. However, the expenditure weights are only available for the 115 basic headings (corresponding to the national accounts). So the prices for uncommonly consumed goods within a given basic heading may end up getting undue weight. This problem could be avoided by only pricing representative country-specific bundles, but this would reintroduce the quality bias discussed above, which has plagued past ICP rounds. Using region-specific bundles helps get around the problem, though it also arises in the ring comparisons used to compare price levels in different regions.[13] Second, there is a problem of "urban bias" in the ICP surveys for some countries; the next section describes our methods of addressing this problem. Third, as was argued in RDV, the weights attached to different commodities in the conventional PPP rate may not be appropriate for the poor; Section VII examines the sensitivity of our results to the use of alternative "PPPs for the poor" available for a subset of countries from Deaton and Dupriez (2009). Fourth, the PPP is a national average. Just as the cost of living tends to be lower in poorer countries, one expects it to be lower in poorer regions within one country, especially in rural areas. Ravallion, Chen, and Sangraula (2007) have allowed for urban–rural cost-of-living differences facing the poor, and provided an urban–rural breakdown of our prior global poverty measures using the 1993 PPP. We plan to update these estimates in future work.

What do these revisions to past PPPs imply for measures of global extreme poverty? Given that the bulk of the PPPs have risen for developing countries, the poverty count will tend to rise at any *given* poverty line in PPP dollars. However, the story is more

13. The OECD and Eurostat have used controls for "representativeness" (based on the price survey), following Cuthbert and Cuthbert (1988). This has not been done for developing countries.

complex, given that the same changes in the PPPs alter the (endogenous) international poverty line, which is anchored to the national poverty lines in the poorest countries in local currency units. Next we turn to the poverty lines, and then the household surveys, after which we will be able to put the various data together to see what they suggest about the extent of poverty in the world.

III. National and International Poverty Lines

We use a range of international lines, representative of the national lines found in the world's poorest countries. For this purpose, RCS compiled a new set of national poverty lines for developing countries drawn from the World Bank's country-specific Poverty Assessments (PAs) and the Poverty Reduction Strategy Papers (PRSP) done by the governments of the countries concerned. These documents provide a rich source of data on poverty at the country level, and almost all include estimates of national poverty lines. The RCS data set was compiled from the most recent PAs and PRSPs over the years 1988–2005. In the source documents, each poverty line is given in the prices for a specific survey year (for which the subsequent poverty measures are calculated). In most cases, the poverty line was also calculated from the same survey (though there are some exceptions, for which preexisting national poverty lines, calibrated to a prior survey, were updated using the consumer price index). About 80% of these reports used a version of the "cost of basic needs" method in which the food component of the poverty line is the expenditure needed to purchase a food bundle specific to each country that yields a stipulated food energy requirement.[14] To this is added an allowance for nonfood spending, which is typically anchored to the nonfood spending of people whose food spending, or sometimes total spending, is near the food poverty line.

There are some notable differences between the old (RDV) and new (RCS) data sets on national poverty lines. The RDV data were for the 1980s (with a mean year of 1984), whereas the new and larger compilation in RCS is post-1990 (mean of 1999); in no case do the proximate sources overlap. The RCS data cover 75 developing countries, whereas the earlier data included only 22. The

14. This method, and alternatives, are discussed in detail in Ravallion (1994, 2008c).

RDV data set used rural poverty lines when there was a choice, whereas the RCS data set estimated national average lines. And the RDV data set was unrepresentative of the poorest region, Sub-Saharan Africa (SSA), with only four countries from that region (Burundi, South Africa, Tanzania, and Zambia), whereas the RCS data set has a good spread across regions. The sample bias in the RDV data set was unavoidable at the time (1990), but it can now be corrected.

Although there are similarities across countries in how poverty lines are set, there is considerable scope for discretion. National poverty lines must be considered socially relevant in the specific country.[15] If a proposed poverty line is widely seen as too frugal by the standards of a society, then it will surely be rejected. Nor will a line that is too generous be easily accepted. The stipulated food-energy requirements are similar across countries, but the food bundles that yield a given nutritional intake can vary enormously (as in the share of calories from course starchy staples rather than more processed food grains, and the share from meat and fish). The nonfood components also vary. The judgments made in setting the various parameters of a poverty line are likely to reflect prevailing notions of what poverty means in each country.

There must be a lower bound to the cost of the nutritional requirements for any given level of activity (with the basal metabolic rate defining an absolute lower bound). The cost of the (food and nonfood) goods needed for social needs must also be bounded below (as argued by Ravallion and Chen [2010]). The poverty lines found in many poor countries are certainly frugal. For example, the World Bank (1997) gives the average daily food bundle consumed by someone living in the neighborhood of India's national poverty in 1993. The daily food bundle comprised 400 g of coarse rice and wheat and 200 g of vegetables, pulses, and fruit, plus modest amounts of milk, eggs, edible oil, spices, and tea. After buying such a food bundle, one would have about $0.30 left (at 1993 PPP) for nonfood items. India's official line is frugal by international standards, even among low-income countries (Ravallion 2008a). To give another example, the daily food bundle used by Bidani and Ravallion (1993) to construct Indonesia's poverty line comprises 300 g of rice, 100 g of tubers, and amounts of vegetables,

15. This is no less true of the poverty lines constructed for World Bank Poverty Assessments, which emerge out of close collaboration between the technical team (often including local statistical staff and academics) and the government of the country concerned.

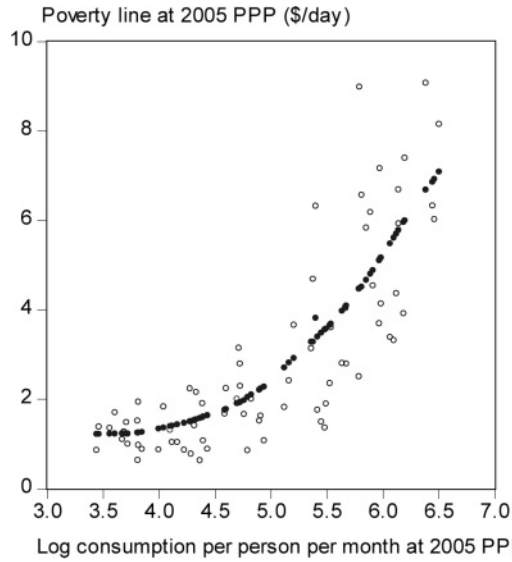

FIGURE I
National Poverty Lines Plotted against Mean Consumption at 2005 PPP
Bold symbols are fitted values from a nonparametric regression.

fruits, and spices similar to those in the India example but also includes fish and meat (about 140 g in all per day).

Such poverty lines are clearly too low to be acceptable in rich countries, where much higher overall living standards mean that higher standards are also used for identifying the poor. For example, the U.S. official poverty line in 2005 for a family of four was $13 per person per day (http://aspe.hhs.gov/poverty/05poverty.shtml). Similarly, we can expect middle-income countries to have higher poverty lines than low-income countries.

The expected pattern in how national poverty lines vary is confirmed by Figure I, which plots the poverty lines compiled by RCS in 2005 PPP dollars against log household consumption per capita, also in 2005 PPP dollars, for the 74 countries with complete data. The figure gives a nonparametric regression of the national poverty lines against log mean consumption. Above a certain point, the poverty line rises with mean consumption. The overall elasticity of the poverty line to mean consumption is about 0.7. However, the slope is essentially zero among the poorest 20 or so countries, where absolute poverty clearly dominates. The gradient evident in Figure I is driven more by the nonfood component of

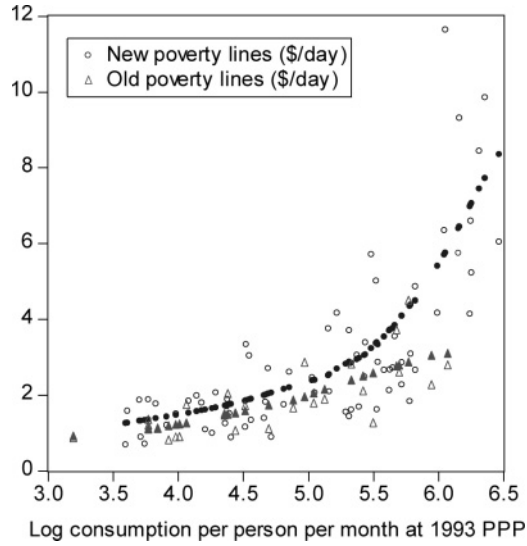

FIGURE II
Comparison of New and Old National Poverty Lines at 1993 PPP
Bold symbols are fitted values from a nonparametric regression.

the poverty lines (which accounts for about 60% of the overall elasticity) than the food component, although there is still an appreciable share attributable to the gradient in food poverty lines (RCS).

To help see how this new compilation of national poverty lines compares to those used to set the original "$1-a-day" line, Figure II gives both the RCS and RDV lines evaluated at 1993 prices and converted to dollars using the 1993 PPPs; both sets of national poverty lines are plotted against consumption per capita at 1993 PPP. The relationship between the RCS national poverty lines and consumption per capita (at 1993 PPP) looks similar to Figure I, although the 1993 PPPs suggest a slightly steeper gradient amongst the poorest countries. But the more important observation from Figure II is that the RDV lines are lower at given mean consumption; the absolute gap diminishes as consumption falls, but still persists among the poorest countries. For the poorest fifteen countries ranked by consumption per capita at 1993 PPP, the mean poverty line in the RCS data set is $43.92 ($1.44 a day[16]) versus $33.51 ($1.10 a day) using the old (RDV) series

16. Note that this is at 1993 PPP; $1.44 in 1993 prices represents $1.95 a day at 2005 U.S. prices.

for eight countries with consumption below the upper bound of consumption for those fifteen countries. The RCS sample is more recent, and possibly there has been some upward drift in national poverty lines over time, although that does not seem very likely given that few growing developing countries have seen an upward revision to their poverty lines, which can be politically difficult. (Upward revisions have a long cycle; for example, China and India are only now revising upward their official poverty lines, which stood for 30–40 years.) The other differences in the two samples noted above may well be more important in explaining the upward shift seen in Figure II in moving from the RDV to RCS samples. For example, there is some evidence that poverty lines for SSA tend to be higher than for countries at similar mean consumption levels (RCS), and (as noted above) SSA was underrepresented in the original RDV data set of national poverty lines.[17]

We use five international poverty lines at 2005 PPP: (i) $1.00 a day, which is very close to India's national poverty line;[18] (ii) $1.25, which is the mean poverty line for the poorest fifteen countries;[19] (iii) $1.45, obtained by updating the 1993 $1.08 line used by Chen and Ravallion (2001, 2004, 2007) for inflation in the United States; (iv) $2.00, which is the median of the RCS sample of national poverty lines for developing and transition economies and is also approximately the line obtained by updating the $1.45 line at 1993 PPP for inflation in the United States; and (v) $2.50, twice the $1.25 line, which is also the median poverty line of all *except* the poorest fifteen countries in the RCS data set of national poverty lines. The range from $1.00 to $1.45 is roughly the 95% confidence

17. The residuals in Figure I are about $0.44 per day higher for SSA on average, with a standard error of $0.27.

18. India's official poverty lines for 2004/2005 were Rs 17.71 and Rs 11.71 per day for urban and rural areas. Using our urban and rural PPPs for 2005, these represent $1.03 per day (Ravallion 2008a). An Expert Group constituted by the Planning Commission (2009) has recently recommended a higher rural poverty line, although retaining the prior official line for urban areas. The implied new national line is equivalent to $1.17 per day for 2005 when evaluated at our implicit urban and rural PPPs. Note that the Expert Group does not claim that the higher line is a "relative poverty" effect, but rather that it corrects for claimed biases in past price deflators.

19. The fifteen countries are mostly in SSA and comprise Malawi, Mali, Ethiopia, Sierra Leone, Niger, Uganda, Gambia, Rwanda, Guinea-Bissau, Tanzania, Tajikistan, Mozambique, Chad, Nepal, and Ghana. Their median poverty line is $1.27 per day. Note that this is a set of reference countries different from those used by RDV. Deaton (2010) questions this change in the set of reference countries. However, it would be hard to justify keeping the reference group fixed over time, given what we now know about the bias in the original RDV sample of national lines.

interval for the mean poverty line for the poorest fifteen countries (RCS). To test the robustness of qualitative comparisons, we also estimate the cumulative distribution functions (CDFs) up to a maximum poverty line, which we set at the U.S. line of $13 per day.[20]

Although we present results for multiple poverty lines, we consider the $1.25 line the closest in sprit to the original idea of the "$1-a-day" line. The use of the poorest fifteen countries as the reference group has a strong rationale. The relationship between the national poverty lines and consumption per person can be modeled very well (in terms of goodness of fit) by a piecewise linear function that has zero slope up to some critical level of consumption, and rises above that point. The econometric tests reported in RCS imply that national poverty lines tend to rise with consumption per person when it exceeds about $2 per day, which is very near the upper bound of the consumption levels found among these fifteen countries.[21] Of course, there is still variance in the national poverty lines at any given mean, including among the poorest countries; RCS estimate the robust standard error of the $1.25 line to be $0.10 per day.

We use the same PPPs to convert the international lines to local currency units (LCUs). Three countries were treated differently, China, India, and Indonesia. In all three we used separate urban and rural distributions. For China, the ICP survey was confined to 11 cities, and the evidence suggests that the cost of living is lower for the poor in rural areas (Chen and Ravallion 2010). We treat the ICP PPP as an urban PPP for China and use the ratio of urban to rural national poverty lines to derive the corresponding rural poverty line in local currency units. For India, the ICP included rural areas, but they were underrepresented. We derived urban and rural poverty lines consistent with both the urban–rural differential in the national poverty lines and the relevant

20. First-order dominance up to a poverty line of $z^{\max}$ implies that all standard (additively separable) poverty measures rank the distributions identically for all poverty lines up to $z^{\max}$; see Atkinson (1987). (When CDFs intersect, unambiguous rankings may still be possible for a subset of poverty measures.)

21. RCS use a suitably constrained version of Hansen's (2000) method for estimating a piecewise linear ("threshold") model. (The constraint is that the slope of the lower linear segment must be zero and there is no potential discontinuity at the threshold.) This method gave an absolute poverty line of $1.23 ($t = 6.36$) and a threshold level of consumption (above which the poverty line rises linearly) very close to the $60 per month figure used to define the reference group. Ravallion and Chen (2010) use this piecewise linear function in measuring "weakly relative poverty" in developing countries.

features of the design of the ICP samples for India; further details can be found in Ravallion (2008a). For Indonesia, we converted the international poverty line to LCUs using the official consumption PPP from the 2005 ICP. We then unpack that poverty line to derive implicit urban and rural lines that are consistent with the ratio of the national urban-to-rural lines for Indonesia.

IV. Household Surveys and Poverty Measures

We have estimated all poverty measures ourselves from the primary sample survey data, rather than relying on preexisting poverty or inequality measures of uncertain comparability. The primary data come in various forms, ranging from micro data (the most common) to specially designed grouped tabulations from the raw data, constructed following our guidelines.[22] All our previous estimates have been updated to ensure internal consistency.

We draw on 675 nationally representative surveys for 115 countries.[23] Taking the most recent survey for each country, about 1.23 million households were interviewed in the surveys used for our 2005 estimate. The surveys were mostly done by governmental statistics offices as part of their routine operations. Not all available surveys were included; a survey was dropped if there were known to be serious problems of comparability with the rest of the data set.[24]

IV.A. Poverty Measures

Following past practice, poverty is assessed using household expenditure on consumption per capita or household income per capita as measured from the national sample surveys.[25] Households are ranked by consumption (or income) per person.

22. In the latter case we use parametric Lorenz curves to fit the distributions. These provide a more flexible functional form than the log-normality assumption used by (*inter alia*) Bourguignon and Morrisson (2002) and Pinkovskiy and Sala-i-Martin (2009). Log-normality is a questionable approximation; the tests reported in Lopez and Servén (2006) reject log-normality of consumption, though it performs better for income. Note also that the past papers in the literature have applied log-normality to distributional data for developing countries that have already been generated by our own parametric Lorenz curves, as provided in the World Bank's *World Development Indicators*. This overfitting makes the fit of log-normal distribution to these secondary data look deceptively good.

23. A full listing is found in Chen and Ravallion (2009).

24. Also, we have not used surveys for 2006 or 2007 when we already have a survey for 2005—the latest year for which we provide estimates in this paper.

25. The use of a "per capita" normalization is standard in the literature on developing countries. This stems from the general presumption that there is rather little scope for economies of size in consumption for poor people. However, that assumption can be questioned; see Lanjouw and Ravallion (1995).

The distributions are weighted by household size and sample expansion factors. Thus our poverty counts give the number of people living in households with per capita consumption or income below the international poverty line.

When there is a choice we use consumption rather than income, in the expectation that consumption is the better measure of current economic welfare.[26] Although intertemporal credit and risk markets do not appear to work perfectly, even poor households have opportunities for saving and dissaving, which they can use to protect their living standards from income fluctuations, which can be particularly large in poor agrarian economies. A fall in income due to a crop failure in one year does not necessarily mean destitution. There is also the (long-standing) concern that measuring economic welfare by income entails double counting over time; saving (or investment) is counted initially in income and then again when one receives the returns from that saving. Consumption is also thought to be measured more accurately than income, especially in developing countries. Of the 675 surveys, 417 allow us to estimate the distribution of consumption; this is true of all the surveys used in the Middle East and North Africa (MENA), South Asia, and SSA, although income surveys are more common in Latin America.

The measures of consumption (or income, when consumption is unavailable) in our survey data set are reasonably comprehensive, including both cash spending and imputed values for consumption from own production. But we acknowledge that even the best consumption data need not adequately reflect certain "nonmarket" dimensions of welfare, such as access to certain public services, or intrahousehold inequalities. Furthermore, with the expansion in government spending on basic education and health in developing countries, it can be argued that the omission of the imputed values for these services from survey-based consumption aggregates will understate the rate of poverty reduction. How much so is unclear, particularly in the light of mounting evidence from micro studies on absenteeism of public teachers and healthcare workers in a number of developing countries.[27] However,

26. See Ravallion (1994), Slesnick (1998), and Deaton and Zaidi (2002). Consumption may also be a better measure of long-term welfare, though this is less obvious (Chaudhuri and Ravallion 1994).

27. See Chaudhury et al. (2006). Based on such evidence, Deaton and Heston (2010, p. 44) remark that "To count the salaries of AWOL government employees as 'actual' benefits to consumers adds statistical insult to original injury."

there have clearly been some benefits to poor people from higher public spending on these services. Our sensitivity tests in Section VII, in which we mix survey means with NAS consumption aggregates (which, in principle, should include the value of government services to households), will help address this concern. These and other limitations of consumption as a welfare metric also suggest that our poverty measures need to be supplemented by other data, such as on education attainments and infant and child mortality, to obtain a complete picture of how living standards are evolving.

We use standard poverty measures for which the aggregate measure is the (population-weighted) sum of individual measures. In this paper we report three such poverty measures.[28] The first measure is the *headcount index* given by the percentage of the population living in households with consumption or income per person below the poverty line. We also give estimates of the *number of poor*, as obtained by applying the estimated headcount index to the population of each region under the assumption that the countries without surveys are a random subsample of the region. Our third measure is the *poverty gap index*, which is the mean distance below the poverty line as a proportion of the line where the mean is taken over the whole population, counting the nonpoor as having zero poverty gaps.

Having converted the international poverty line at PPP to local currency in 2005, we convert it to the prices prevailing at each survey date using the most appropriate available country-specific CPI.[29] The weights in this index may or may not accord well with consumer budget shares at the poverty line. In periods of relative price shifts, this will bias our comparisons of the incidence of poverty over time, depending on the extent of (utility-compensated) substitution possibilities for people at the poverty line.

In the aggregate, 90% of the population of the developing world is represented by surveys within two years of 2005.[30] Survey coverage by region varies from 74% of the population of the MENA

28. The website we have created to allow replication of these estimates, PovcalNet, provides a wider range of measures from the literature on poverty measurement.

29. Note that the same poverty line is generally used for urban and rural areas. There are three exceptions, China, India, and Indonesia, where we estimate poverty measures separately for urban and rural areas and use sector-specific CPIs.

30. Some countries have graduated from the set of developing countries; we apply the same definition over time to avoid selection bias. In this paper our definition is anchored to 2005.

to 98% of the population of South Asia. Some countries have more surveys than others; for the 115 countries, 14 have only one survey, 17 have two, and 14 have three, whereas 70 have four or more over the period, of which 23 have 10 or more surveys. Naturally, the further back we go, the smaller the number of surveys—reflecting the expansion in household survey data collection for developing countries since the 1980s. Because the PPP conversion is only done in 2005, estimates may well become less reliable earlier in time, depending on the quality of the national CPIs. Coverage also deteriorates in the last year or two of the series, given the lags in survey processing. We made the judgment that there were too few surveys prior to 1981 or after 2005. The working paper version (Chen and Ravallion 2009) gives further details, including the number of surveys by year, the lags in survey availability, and the proportion of the population represented by surveys by year.

Most regions are quite well covered from the latter half of the 1980s (East and South Asia being well covered from 1981 onward).[31] Unsurprisingly, we have weak coverage in Eastern Europe and Central Asia (EECA) for the 1980s; many of these countries did not officially exist then, so we have to rely heavily on back projections. More worrying is the weak coverage for SSA in the 1980s; indeed, our estimates for the early 1980s rely heavily on projections based on distributions around 1990.

IV.B. Heterogeneity and Measurement Errors in Surveys

Survey instruments differ between countries, including how the questions are asked (such as recall periods), response rates, whether the surveys are used to measure consumption or income, and what gets included in the survey's aggregate for consumption or income. These differences are known to matter to the statistics calculated from surveys, including poverty and inequality measures. It is questionable whether survey instruments should be identical across countries; some adaptation to local circumstances may well make the results more comparable even though the surveys differ. Nonetheless, the heterogeneity is a concern.

The literature on measuring global poverty and inequality has dealt with this concern in two ways. The first makes an effort to iron out obvious comparability problems using the micro data,

31. China's survey data for the early 1980s are probably less reliable than in later years, as discussed in Chen and Ravallion (2004), where we also describe our methods of adjusting for certain comparability problems in the China data, including changes in valuation methods.

either by reestimating the consumption/income aggregates or by the more radical step of dropping a survey. It is expected that aggregation across surveys will help reduce the problem. But beyond this, the problem is essentially ignored. This is the approach we have taken in the past, and for our benchmark estimates below. We call this the "survey-based method."

The second approach rescales the survey means to be consistent with the national accounts (NAS) but assumes that the surveys get the relative distribution ("inequality") right. Thus all levels of consumption or income in the survey are multiplied by the ratio of the per capita NAS aggregate (consumption or GDP) to the survey mean.[32] We can call this the "rescaling method."

The choice depends in part on the data and application. The first method is far more data-intensive, as it requires the primary data, which rules it out for historical purposes (indeed, for estimates much before 1980). For example, Bourguignon and Morrisson (2002) had no choice but to use the rescaling method, given that they had to rely on secondary sources (notably prior inequality statistics) to estimate aggregate poverty and inequality measures back to 1820.

Arguments can also be made for and against each approach. It is claimed by proponents of the rescaling method that it corrects for survey mismeasurement. In this view, NAS consumption is more accurate because it captures things that are often missing from surveys, such as imputed rents for owner-occupied housing and government-provided services to households. Although this is true in principle, compliance with the UN Statistical Division's System of National Accounts (SNA) is uneven across countries in practice. Most developing countries still have not fully implemented SNA guidelines, including those for estimating consumption, which is typically calculated residually at the commodity level. In this and other respects (including how output is measured) the NAS is of questionable reliability in many low-income countries.[33] Given how consumption is estimated in practice in the NAS in most low-income countries, we would be loath to assume it is more accurate than a well-designed survey.

32. In one version of this method, Bhalla (2002) replaces the survey mean by consumption from the NAS. Instead, Bourguignon and Morrisson (2002), Sala-i-Martin (2006), and Pinkovskiy and Sala-i-Martin (2009) anchor their measures to GDP per capita rather than to consumption.

33. As Deaton and Heston (2010, p. 5) put it, "The national income accounts of many low-income countries remain very weak, with procedures that have sometimes not been updated for decades."

Proponents of the survey-based method acknowledge that there are survey measurement errors but question the assumptions of the rescaling method that the gaps between the survey means and NAS aggregates are due solely to underestimation in the surveys and that the measurement errors are distribution-neutral, such that the surveys get inequality right. The discrepancy between the two data sources reflects many factors, including differences in what is included.[34] Selective compliance with the randomized assignment in a survey and underreporting is also playing a role. Survey statisticians do not generally take the view that nonsampling errors affect only the mean and not inequality. More plausibly, underestimation of the mean by surveys due to selective compliance comes with underestimation of inequality.[35] For instance, high-income households might be less likely to participate because of the high opportunity cost of their time or concerns about intrusion in their affairs.[36]

Naturally evidence on this is scarce, but in one study of compliance with the "long form" of the U.S. Census, Groves and Couper (1998, Chapter 5) found that higher socioeconomic status tended to be associated with lower compliance. Estimates by Korinek, Mistiaen, and Ravallion (2007) of the microcompliance function (the individual probability of participating in a survey as a function of own income) for the Current Population Survey in the United States suggest a steep economic gradient, with very high compliance rates for the poor, falling to barely 50% for the rich. Korinek, Mistiaen, and Ravallion (2006) examine the implications of selective compliance for inequality and poverty measurement and find little bias in the poverty measures but sizable underestimation of inequality in the United States. In other words, their results suggest that the surveys underestimate both the mean and inequality but get poverty roughly right;

34. For example, NAS private consumption includes imputed rents for owner-occupied housing, imputed services from financial intermediaries, and the expenditures of nonprofit organizations; none of these are included in consumption aggregates from standard household surveys. Surveys, on the other hand, are probably better at picking up consumption from informal-sector activities. For further discussion, see Ravallion (2003) and Deaton (2005). In the specific case of India (with one of the largest gaps between the survey-based estimates of mean consumption and that from the NAS), see Central Statistical Organization (2008).

35. Although the qualitative implications for an inequality measure of even a monotonic income effect on compliance are theoretically ambiguous (Korinek, Mistiaen, and Ravallion 2006).

36. Groves and Couper (1998) provide a useful overview of the arguments and evidence on the factors influencing survey compliance.

replacing the survey mean with consumption from the NAS would underestimate poverty.

This may be a less compelling argument for some other sources of divergence between the survey mean and NSS consumption per person. Suppose, for example, that the surveys exclude imputed rent for owner-occupied housing (practices are uneven in how this is treated) *and* that this is a constant proportion of expenditure. Then the surveys get inequality right and the mean wrong. Similarly, the private consumption aggregate in the NAS should include government expenditures on services consumed by households, which are rarely valued in surveys. Of course, it is questionable whether these items could be treated as a constant proportion of expenditure.

The implications of measurement errors also depend on how the poverty line is set. Here it is important to note that the underlying national poverty lines were largely calibrated to the surveys. Measurement errors will be passed on to the poverty lines in a way that attenuates the bias in the final measure of poverty. By the most common methods of setting poverty lines, underestimation of nonfood spending in the surveys will lead to underestimation of the poverty line, which is anchored to the spending of sampled households living near the food poverty line (or with food-energy intakes near the recommended norms). Correcting for underestimation of nonfood spending in surveys would then require higher poverty lines. The poverty measures based on these poverty lines will then be more robust to survey measurement errors than would be the case if the line was set independent of the surveys.

IV.C. A Mixed Method

Arguably the more important concern here is the heterogeneity of surveys, given that the level of the poverty line is always somewhat arbitrary. In an interesting variation on the rescaling method, Karshenas (2003) replaces the survey mean by its predicted value from a regression on NAS consumption per capita. So Karshenas uses a stable linear function of NAS consumption, with mean equal to the overall mean of the survey means. This assumes that national accounts consumption data are comparable and ignores the country-specific information on the levels in surveys. As noted above, that is a questionable assumption. However, unlike other examples of rescaling methods, Karshenas assumes that the surveys are correct on average and focuses instead on the

problem of survey comparability, for which purpose the poverty measures are anchored to the national accounts data.

Where we depart from the Karshenas method is that we do not ignore the country-specific survey means. When one has two less-than-ideal measures of roughly the same thing, it is natural to combine them. For virtually all developing countries, surveys are far less frequent than NAS data. Because one is measuring poverty at the survey date, the survey can be thought of as the Bayesian posterior estimate, whereas NAS consumption is the Bayesian prior. A result from Bayesian statistics then provides an interpretation of a mixing parameter under the assumption that consumption is log-normally distributed with a common variance in the prior distribution as in the new survey data. That assumption is unlikely to hold; log-normality of consumption can be rejected statistically (Lopez and Servén 2006), and (as noted) it is unlikely that the prior based on the NAS would have the same relative distribution as the survey. However, this assumption does at least offer a clear conceptual foundation for a sensitivity test, given the likely heterogeneity in surveys. In particular, it can then be shown readily that if the prior is the expected value of the survey mean, conditional on national accounts consumption, and consumption is log-normally distributed with a common variance, then the posterior estimate is the geometric mean of the survey mean and its expected value.[37] Over time, the relevant growth rate is the (arithmetic) mean of the growth rates from the two data sources.

V. Benchmark Estimates

We report aggregate results for nine "benchmark years," at three-yearly intervals over 1981–2005, for the regions of the developing world and (given their populations) China and India.[38] Jointly with this paper, we have updated the PovcalNet website to provide public access to the underlying country-level data set, so that users can replicate these calculations and try different assumptions, including different poverty measures, poverty lines, and country groupings, including deriving estimates for individual countries. The PovcalNet site will also provide updates as new data come in.

37. The working paper version (Chen and Ravallion 2009) provides a proof.

38. Chen and Ravallion (2004) describe our interpolation and projection methods to deal with the fact that national survey years differ from our benchmark years.

TABLE I
HEADCOUNT INDICES OF POVERTY (% BELOW EACH LINE)

	1981	1984	1987	1990	1993	1996	1999	2002	2005
(a) Aggregate for developing world									
$1.00	41.4	34.4	29.8	29.5	27.0	23.1	22.8	20.3	16.1
$1.25	51.8	46.6	41.8	41.6	39.1	34.4	33.7	30.6	25.2
$1.45	58.4	54.4	49.9	49.4	47.2	42.6	41.6	38.1	32.1
$2.00	69.2	67.4	64.2	63.2	61.5	58.2	57.1	53.3	47.0
$2.50	74.6	73.7	71.6	70.4	69.2	67.2	65.9	62.4	56.6
(b) Excluding China									
$1.00	29.4	27.6	26.9	24.4	23.3	22.9	22.3	20.7	18.6
$1.25	39.8	38.3	37.5	35.0	34.1	33.8	33.1	31.3	28.2
$1.45	46.6	45.5	44.5	42.3	41.6	41.4	40.8	38.9	37.0
$2.00	58.6	58.1	57.2	55.6	55.6	55.9	55.6	54.0	50.3
$2.50	65.9	66.7	67.3	65.4	66.0	67.9	67.4	66.0	62.9

Note. The headcount index is the percentage of the relevant population living in households with consumption per person below the poverty line.

V.A. Aggregate Measures

Table I gives our new estimates for a range of lines from $1.00 to $2.50 in 2005 prices. Table II gives the corresponding counts of the number of poor. We calculate the global aggregates under the assumption that the countries without surveys have the poverty rates of their region. The following discussion will focus more on the $1.25 line, though we test the robustness of our qualitative poverty comparisons to that choice.

We find that the percentage of the population of the developing world living below $1.25 per day was halved over the 25-year period, falling from 52% to 25% (Table I). (Expressed as a proportion of the population of the world, the decline is from 42% to 21%; this assumes that there is nobody living below $1.25 per day in the developed countries.[39]) The number of poor fell by slightly over 500 million, from 1.9 billion to 1.4 billion over 1981–2005 (Table II). The trend rate of decline in the $1.25 a day poverty rate over 1981–2005 was 1% per year; when the poverty rate is regressed on time the estimated trend is −0.99% per year with a standard error of 0.06% ($R^2 = .97$). This is slightly higher than the trend we had obtained using the 1993 PPPs, which was −0.83% per year (standard error = 0.11%). When this trend is simply projected

39. The population of the developing world in 2005 was 5,453 million, representing 84.4% of the world's total population; in 1981, it was 3,663 million, or 81.3% of the total.

TABLE II
NUMBERS OF POOR (MILLIONS)

	1981	1984	1987	1990	1993	1996	1999	2002	2005
					(a) Aggregate for developing world				
$1.00	1,515.0	1,334.7	1,227.2	1,286.7	1,237.9	1,111.9	1,145.6	1,066.6	876.0
$1.25	1,896.2	1,808.2	1,720.0	1,813.4	1,794.9	1,656.2	1,696.2	1,603.1	1,376.7
$1.45	2,137.7	2,111.5	2,051.7	2,153.5	2,165.0	2,048.1	2,095.7	1,997.9	1,751.7
$2.00	2,535.1	2,615.4	2,639.7	2,755.9	2,821.4	2,802.1	2,872.1	2,795.7	2,561.5
$2.50	2,731.6	2,858.7	2,944.6	3,071.0	3,176.7	3,231.4	3,316.6	3,270.6	3,084.7
					(b) Excluding China				
$1.00	784.5	786.2	814.9	787.6	793.4	823.2	843.2	821.9	769.9
$1.25	1,061.1	1,088.3	1,134.3	1,130.2	1,162.3	1,213.4	1,249.5	1,240.0	1,169.0
$1.45	1,244.0	1,293.2	1,348.9	1,365.3	1,418.9	1,488.1	1,541.7	1,543.5	1,535.2
$2.00	1,563.0	1,652.1	1,732.7	1,795.1	1,895.2	2,009.9	2,101.9	2,140.8	2,087.9
$2.50	1,759.5	1,895.4	2,037.6	2,110.2	2,250.4	2,439.2	2,546.4	2,615.6	2,611.0

forward to 2015, the estimated headcount index for that year is 16.6% (standard error of 1.5%).

Given that the 1990 poverty rate was 41.6%, the new estimates indicate that the developing world as a whole is on track to achieving the Millennium Development Goal (MDG) of halving the 1990 poverty rate by 2015. The 1% per year rate of decline in the poverty rate also holds if one focuses on the period since 1990 (not just because this is the base year for the MDG but also recalling that the data for the 1980s are weaker). The $1.25 poverty rate fell 10% in the ten years of the 1980s (from 52% to 42%) and a further 17% in the 16 years from 1990 to 2005.

It is notable that 2002–2005 suggests a higher (absolute and proportionate) drop in the poverty rate than other periods. Given that lags in survey data availability mean that our 2005 estimate is more heavily dependent on nonsurvey data (notably the extrapolations based on NAS consumption growth rates), there is a concern that this sharper decline over 2002–2005 might be exaggerated. However, that does not seem likely. The bulk of the decline is in fact driven by countries for which survey data are available close to 2005. The region for which nonsurvey data have played the biggest role for 2005 is SSA. If instead we assume that there was in fact no decline in the poverty rate over 2002–2005 in SSA, then the total headcount index (for all developing countries) for the $1.25 line in 2005 is 26.2%—still suggesting a sizable decline relative to 2002.

China's success against absolute poverty has clearly played a major role in this overall progress. The lower panels of Tables I and II repeat the calculations excluding China. The $1.25 a day poverty rate falls from 40% to 28% over 1981–2005, with a rate of decline that is less than half the trend including China; the regression estimate of the trend falls to −0.43% per year (standard error of 0.03%; $R^2 = .96$), which is almost identical to the rate of decline for the non-China developing world that we had obtained using the 1993 PPPs (which gave a trend of −0.44% per year, standard error = 0.01%). Based on our new estimates, the projected value for 2015 is 25.1% (standard error = 0.8%), which is well over half the 1990 value of 35%. So the developing world outside China is *not* on track to reach the MDG for poverty reduction.

Our estimates suggest less progress (in absolute and proportionate terms) in getting above the $2 per day line than the $1.25 line. The poverty rate by this higher standard has fallen from 70%

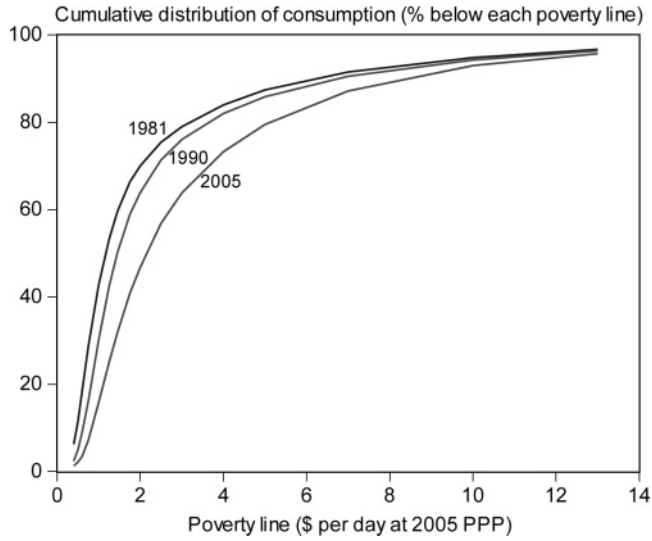

FIGURE III
Cumulative Distributions for the Developing World

in 1981 to 47% in 2005 (Table I). The trend is about 0.8% per year (a regression coefficient on time of −0.84; standard error = 0.08); excluding China, the trend is only 0.3% per year (a regression coefficient of −0.26; standard error = 0.05%). This has not been sufficient to bring down the number of people living below $2 per day, which was about 2.5 billion in both 1981 and 2005 (Table II). Thus the number of people living *between* $1.25 and $2 a day has risen sharply over these 25 years, from about 600 million to 1.2 billion. This marked "bunching up" of people just above the $1.25 line suggests that the poverty rate according to that line could rise sharply with aggregate economic contraction (including real contraction due to higher prices).

The qualitative conclusions that poverty measures have fallen over 1981–2005 and 1990–2005 are robust to the choice of poverty line over a wide range (and robust to the choice of poverty measure within a broad class of measures). Figure III gives the cumulative distribution functions up to $13 per day, which is the official poverty line per person for a family of four in the United States in 2005. First-order dominance is indicated. In 2005, 95.7% of the population of the developing world lived below the U.S. poverty line; 25 years earlier it was 96.7%.

V.B. Regional Differences

Table III gives the estimates over 1981–2005 for four lines, $1.00, $1.25, $2.00, and $2.50. There have been notable changes in regional poverty rankings over this period. Looking back to 1981, East Asia had the highest incidence of poverty, with 78% of the population living below $1.25 per day and 93% below the $2 line. South Asia had the next highest poverty rate, followed by SSA, LAC, MENA, and lastly EECA. Twenty years later, SSA had swapped places with East Asia, where the $1.25 headcount index had fallen to 17%, with South Asia staying in second place. EECA had overtaken MENA. The regional rankings are not robust to the poverty line. Two changes are notable. At lower lines (under $2 per day) SSA has the highest incidence of poverty, but this switches to South Asia at higher lines. (Intuitively, this difference reflects the higher inequality found in Africa than in South Asia.) Second, MENA's poverty rate exceeds LAC's at $2 or higher, but the ranking reverses at lower lines.

The composition of world poverty has changed noticeably over time. The number of poor has fallen sharply in East Asia but risen elsewhere. For East Asia, the MDG of halving the 1990 "$1-per-day" poverty rate by 2015 was already reached a little after 2002. Again, China's progress against absolute poverty was a key factor; looking back to 1981, China's incidence of poverty (measured by the percentage below $1.25 per day) was roughly twice that for the rest of the developing world; by the mid-1990s, the Chinese poverty rate had fallen well below average. There were over 600 million fewer people living under $1.25 per day in China in 2005 than 25 years earlier. Progress was uneven over time, with setbacks in some periods (the late 1980s) and more rapid progress in others (the early 1980s and mid 1990s). Ravallion and Chen (2007) identify a number of factors (including policies) that account for this uneven progress against poverty over time (and space) in China.

Over 1981–2005, the $1.25 poverty rate in South Asia fell from almost 60% to 40%, which was not sufficient to bring down the number of poor (Table IV). If the trend over this period in South Asia were to continue until 2015, the poverty rate would fall to 32.5% (standard error = 1.2%), which is more than half its 1990 value. So South Asia is not on track to attaining the MDG without a higher trend rate of poverty reduction. Note, however, that this conclusion is not robust to the choice of the poverty line.

TABLE III

REGIONAL BREAKDOWN OF HEADCOUNT INDEX FOR INTERNATIONAL POVERTY LINES OF $1.00–$2.50 A DAY OVER 1981–2005

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
(a) % living below $1.00 a day									
East Asia and Pacific	66.8	49.9	38.9	39.1	35.4	23.4	23.5	17.8	9.3
Of which China	73.5	52.9	38.0	44.0	37.7	23.7	24.1	19.1	8.1
Eastern Europe and Central Asia	0.7	0.6	0.5	0.9	2.1	2.5	3.1	2.7	2.2
Latin America and Caribbean	7.7	9.2	8.9	6.6	6.0	7.3	7.4	7.7	5.6
Middle East and North Africa	3.3	2.4	2.3	1.7	1.5	1.6	1.7	1.4	1.6
South Asia	41.9	38.0	36.6	34.0	29.3	29.1	26.9	26.5	23.7
Of which India	42.1	37.6	35.7	33.3	31.1	28.6	27.0	26.3	24.3
Sub-Saharan Africa	42.6	45.2	44.1	47.5	46.4	47.6	47.0	43.8	39.9
Total	41.4	34.4	29.8	29.5	27.0	23.1	22.8	20.3	16.1
(b) % living below $1.25 a day									
East Asia and Pacific	77.7	65.5	54.2	54.7	50.8	36.0	35.5	27.6	16.8
Of which China	84.0	69.4	54.0	60.2	53.7	36.4	35.6	28.4	15.9
Eastern Europe and Central Asia	1.7	1.3	1.1	2.0	4.3	4.6	5.1	4.6	3.7
Latin America and Caribbean	11.5	13.4	12.6	9.8	9.1	10.8	10.8	11.0	8.2
Middle East and North Africa	7.9	6.1	5.7	4.3	4.1	4.1	4.2	3.6	3.6
South Asia	59.4	55.6	54.2	51.7	46.9	47.1	44.1	43.8	40.3
Of which India	59.8	55.5	53.6	51.3	49.4	46.6	44.8	43.9	41.6
Sub-Saharan Africa	53.7	56.2	54.8	57.9	57.1	58.7	58.2	55.1	50.9
Total	51.8	46.6	41.8	41.6	39.1	34.4	33.7	30.6	25.2

TABLE III
(CONTINUED)

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
				(c) % living below $2.00 a day					
East Asia and Pacific	92.6	88.5	81.6	79.8	75.8	64.1	61.8	51.9	38.7
Of which China	97.8	92.9	83.7	84.6	78.6	65.1	61.4	51.2	36.3
Eastern Europe and Central Asia	8.3	6.5	5.6	6.9	10.3	11.9	14.3	12.0	8.9
Latin America and Caribbean	22.5	25.3	23.3	19.7	19.3	21.8	21.4	21.7	16.6
Middle East and North Africa	26.7	23.1	22.7	19.7	19.8	20.2	19.0	17.6	16.9
South Asia	86.5	84.8	83.9	82.7	79.7	79.9	77.2	77.1	73.9
Of which India	86.6	84.8	83.8	82.6	81.7	79.8	78.4	77.5	75.6
Sub-Saharan Africa	74.0	75.7	74.2	76.2	76.0	77.9	77.6	75.6	73.0
Total	69.2	67.4	64.2	63.2	61.5	58.2	57.1	53.3	47.0
				(d) % living below $2.50 a day					
East Asia and Pacific	95.4	93.5	89.7	87.3	83.7	74.9	71.7	62.6	50.7
Of which China	99.4	97.4	92.4	91.6	86.5	76.4	71.7	61.6	49.5
Eastern Europe and Central Asia	15.2	12.5	11.2	12.0	15.1	18.3	21.4	17.8	12.9
Latin America and Caribbean	29.2	32.4	29.6	26.0	25.9	28.8	28.0	28.4	22.1
Middle East and North Africa	39.0	34.8	34.6	31.2	31.4	32.5	30.8	29.5	28.4
South Asia	92.6	91.5	90.8	90.3	88.6	88.5	86.7	86.5	84.4
Of which India	92.5	91.5	90.8	90.2	89.9	88.7	87.6	86.9	85.7
Sub-Saharan Africa	81.0	82.3	81.0	82.5	82.5	84.2	83.8	82.5	80.5
Total	74.6	73.7	71.6	70.4	69.2	67.2	65.9	62.4	56.6

TABLE IV

REGIONAL BREAKDOWN OF NUMBER OF POOR (MILLIONS) FOR INTERNATIONAL POVERTY LINES OF $1.00–$2.50 A DAY OVER 1981–2005

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
(a) Number living below $1.00 a day									
East Asia and Pacific	921.7	721.8	590.2	623.4	588.7	404.9	420.8	326.8	175.6
Of which China	730.4	548.5	412.4	499.1	444.4	288.7	302.4	244.7	106.1
Eastern Europe and Central Asia	3.0	2.4	2.1	4.1	10.1	11.7	14.4	12.6	10.2
Latin America and Caribbean	28.0	35.8	36.9	29.0	27.6	35.6	37.8	40.7	30.7
Middle East and North Africa	5.6	4.6	4.7	3.8	3.7	4.1	4.7	3.9	4.7
South Asia	387.3	374.3	384.4	381.2	348.8	368.0	359.5	372.5	350.5
Of which India	296.1	282.2	285.3	282.5	280.1	271.3	270.1	276.1	266.5
Sub-Saharan Africa	169.4	195.9	209.0	245.2	259.0	287.6	308.4	310.1	304.2
Total	1,515.0	1,334.7	1,227.2	1,286.7	1,237.9	1,111.9	1,145.6	1,066.6	876.0
(b) Number living below $1.25 a day									
East Asia and Pacific	1,071.5	947.3	822.4	873.3	845.3	622.3	635.1	506.8	316.2
Of which China	835.1	719.9	585.7	683.2	632.7	442.8	446.7	363.2	207.7
Eastern Europe and Central Asia	7.1	5.7	4.8	9.1	20.1	21.8	24.3	21.7	17.3
Latin America and Caribbean	42.0	52.3	52.3	42.9	41.8	52.2	54.8	58.4	46.1
Middle East and North Africa	13.7	11.6	11.9	9.7	9.8	10.6	11.5	10.3	11.0
South Asia	548.3	547.6	569.1	579.2	559.4	594.4	588.9	615.9	595.6
Of which India	420.5	416.0	428.0	435.5	444.3	441.8	447.2	460.5	455.8
Sub-Saharan Africa	213.7	243.8	259.6	299.1	318.5	355.0	381.6	390.0	390.6
Total	1,896.2	1,808.2	1,720.0	1,813.4	1,794.9	1,656.2	1,696.2	1,603.1	1,376.7

TABLE IV
(CONTINUED)

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
(c) Number living below $2.00 a day									
East Asia and Pacific	1,277.7	1,280.2	1,238.5	1,273.7	1,262.1	1,108.1	1,104.9	954.1	728.7
Of which China	972.1	963.3	907.1	960.8	926.3	792.2	770.2	654.9	473.7
Eastern Europe and Central Asia	35.0	28.4	25.1	31.9	48.6	56.2	67.6	56.8	41.9
Latin America and Caribbean	82.3	98.8	96.3	86.3	88.9	105.7	108.5	114.6	91.3
Middle East and North Africa	46.3	43.9	47.1	44.4	48.0	52.2	51.9	50.9	51.5
South Asia	799.5	835.9	881.5	926.0	950.0	1,008.8	1,030.8	1,083.7	1,091.5
Of which India	608.9	635.6	669.0	701.6	735.0	757.1	782.8	813.1	827.7
Sub-Saharan Africa	294.2	328.3	351.3	393.6	423.8	471.1	508.5	535.6	556.7
Total	2,535.1	2,615.4	2,639.7	2,755.9	2,821.4	2,802.1	2,872.1	2,795.7	2,561.5
(d) Number living below $2.50 a day									
East Asia and Pacific	1,315.8	1,352.8	1,361.9	1,393.7	1,393.7	1,293.9	1,282.8	1,150.5	955.2
Of which China	987.5	1,009.8	1,001.7	1,040.4	1,019.0	930.2	899.2	788.8	645.6
Eastern Europe and Central Asia	64.3	54.4	50.2	55.7	71.0	86.4	101.2	84.0	61.0
Latin America and Caribbean	106.9	126.3	122.6	113.9	119.5	139.5	142.1	150.5	121.8
Middle East and North Africa	67.6	66.1	71.8	70.3	75.9	83.8	84.2	85.2	86.7
South Asia	855.0	902.1	954.6	1,011.0	1,056.1	1,118.5	1,156.8	1,216.3	1,246.2
Of which India	650.3	686.1	725.0	766.5	808.8	841.1	875.2	911.4	938.0
Sub-Saharan Africa	322.0	356.9	383.5	426.4	460.6	509.4	549.5	584.0	613.7
Total	2,731.6	2,858.7	2,944.6	3,071.0	3,176.7	3,231.4	3,316.6	3,270.6	3,084.7

If instead we use a lower line of $1.00 per day at 2005 prices, then the poverty rate would fall to 15.7% (standard error = 1.3%) by 2015, which is less than half the 1990 value of 34.0%. Not surprisingly (given its population weight), the same observations hold for India, which is not on track for attaining the MDG using the $1.25 line but is on track using the $1.00 line, which is also closer to the national poverty line in India.[40] The extent of the "bunching up" that has occurred between $1.25 and $2 per day is particularly striking in both East and South Asia, where we find a total of about 900 million people living between these two lines, roughly equally split between the two sides of Asia. Although this points again to the vulnerability of the poor, by the same token it also suggests that substantial further impacts on poverty can be expected from economic growth, provided that it does not come with substantially higher inequality.

We find a declining trend in LAC's poverty rate but not enough to reduce the count of the number of poor over the 1981–2005 period as a whole, though with more encouraging signs of progress since 1999. MENA has experienced a fairly steady decline in the poverty rate, though (again) not sufficient to avoid a rising count of poor in that region.

We find generally rising poverty in EECA using the lower lines ($1.00 and $1.25 a day) though there are very few people who are poor by this standard in EECA. The $2.50-a-day line is more representative of the poverty lines found in the relatively poorer countries of EECA. By this standard, the poverty rate in EECA has shown little clear trend over time in either direction, though there are encouraging signs of a decline in poverty since the late 1990s. The paucity of survey data for EECA in the 1980s should also be recalled. Thus our estimates are heavily based on extrapolations, which do not allow for any changes in distribution. One would expect that distribution was better from the point of view of the poor in EECA in the 1980s, in which case poverty would have been even lower than we estimate—and the increase over time even larger.

The incidence of poverty in SSA fell only slightly over the period as a whole, from 54% of the population living under $1.25 a day in 1981 to 51% in 2005. The number of poor by our new $1.25-a-day standard has almost doubled in SSA over 1981–2005, from

40. The corresponding poverty rates for the $1.00 line in India are 42.1% (1981), 37.6%, 35.7%, 33.3%, 31.1%, 28.6%, 27.0%, 26.3%, and 24.3% (2005).

214 million to over 390 million. The share of the world's poor by this measure living in Africa has risen from 11% in 1981 to 28% in 2005. The trend increase in SSA's share of poverty is 0.67% points per year (standard error = 0.04% points), implying that one-third of the world's poor will live in this region by 2015 (more precisely, the projected poverty rate for that year is 33.7%, with a standard error of 0.8%).

However, there are signs of progress against poverty in SSA since the mid-1990s. The $1.25-a-day poverty rate for SSA peaked at 59% in 1996 and fell steadily after, though not enough to bring down the count of poor given population growth. The decline is proportionately higher the lower the poverty line; for the $1-a-day line, the poverty rate in 2005 is 16% lower than its 1996 value.

V.C. Poverty Gaps

Table V gives the PG indices for $1.25 and $2.00 a day. The aggregate PG for 2005 is 7.6% for the $1.25 line and 18.6% for the $2 line. The GDP per capita of the developing world was $11.30 per day in 2005 (at 2005 PPP). The aggregate poverty gap for the $1.25 line is 0.84% of GDP, whereas it is 3.29% for the $2 line. World (including the OECD countries) GDP per capita was $24.58 per day, implying that the global aggregate PG was 0.33% of global GDP using the $1.25 line and 1.28% using $2.[41]

Comparing Tables III and V, it can be seen that the regional rankings in terms of the poverty gap index are similar to those for the headcount index, and the changes over time follow similar patterns. The PG measures magnify the interregional differences seen in the headcount indices. The most striking feature of the results in Table III is the depth of poverty in Africa, with a $1.25-per-day poverty gap index of almost 21%—roughly twice that for the next poorest region by this measure (South Asia). For the $1.25 line, Africa's aggregate poverty gap represents 3.2% of the region's GDP; for the $2 line, it is 9.0%.[42]

Table VI gives the mean consumption of the poor.[43] For 2005, those living below the $1.25-a-day line had a mean consumption

41. This assumes that nobody lives below our international poverty line in the OECD countries. Under this assumption, the aggregate poverty gap as a percentage of global GDP is $PG \cdot (z/\bar{y}) \cdot (N/NW)$, where PG is the poverty gap index (in %), z is the poverty line, $\bar{y}$ is global GDP per capita, N is the population of the developing world, and NW is world population.

42. The GDP per capita of SSA in 2005, at 2005 PPP, was $8.13 per day.

43. The mean consumption of the poor is $(1 - PG/H)z$, where PG is the poverty gap index, H is the headcount index, and z is the poverty line.

TABLE V
POVERTY GAP INDEX (×100) BY REGION OVER 1981–2005

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
				(a) $1.25					
East Asia and Pacific	35.5	24.2	18.8	18.2	16.4	10.5	10.7	8.0	4.0
Of which China	39.3	25.6	18.5	20.7	17.6	10.7	11.1	8.7	4.0
Eastern Europe and Central Asia	0.4	0.3	0.3	0.6	1.6	1.7	1.6	1.3	1.1
Latin America and Caribbean	4.0	4.7	4.7	3.6	3.3	3.9	4.2	4.2	3.2
Middle East and North Africa	1.6	1.3	1.2	0.9	0.8	0.8	0.8	0.7	0.8
South Asia	19.6	17.5	16.4	15.2	12.9	12.6	11.7	11.5	10.3
Of which India	19.6	17.2	15.8	14.6	13.6	12.4	11.7	11.4	10.5
Sub-Saharan Africa	22.9	24.6	24.3	26.6	25.6	25.9	25.7	23.5	21.1
Total	21.3	16.8	14.5	14.2	12.9	11.0	10.9	9.6	7.6
				(b) $2.00					
East Asia and Pacific	54.7	44.9	38.0	37.4	34.8	25.9	25.5	20.2	13.0
Of which China	59.3	47.3	38.2	40.9	36.6	26.3	25.6	20.6	12.2
Eastern Europe and Central Asia	1.9	1.5	1.3	2.0	3.7	4.1	4.5	3.8	3.0
Latin America and Caribbean	8.9	10.2	9.7	7.8	7.4	8.6	8.6	8.7	6.7
Middle East and North Africa	7.4	6.1	5.9	4.8	4.8	4.8	4.6	4.1	4.0
South Asia	40.7	38.4	37.2	35.7	32.8	32.7	31.0	30.8	28.7
Of which India	40.8	38.2	36.7	35.3	34.1	32.4	31.3	30.8	29.5
Sub-Saharan Africa	38.8	40.6	39.8	42.2	41.4	42.3	42.1	39.7	37.0
Total	36.5	32.5	29.5	29.1	27.5	24.7	24.3	22.1	18.6

Note. The poverty gap index is the mean distance below the poverty line as a proportion of the line where the mean is taken over the whole population, counting the nonpoor as having zero poverty gaps.

TABLE VI
MEAN CONSUMPTION OF THE POOR ($ PER DAY) BY REGION OVER 1981–2005

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
			(a) $1.25						
East Asia and Pacific	0.68	0.79	0.81	0.83	0.85	0.88	0.87	0.89	0.95
Of which China	0.67	0.79	0.82	0.82	0.84	0.88	0.86	0.87	0.94
Eastern Europe and Central Asia	0.97	0.95	0.95	0.84	0.79	0.78	0.86	0.91	0.89
Latin America and Caribbean	0.82	0.82	0.78	0.79	0.80	0.79	0.77	0.78	0.77
Middle East and North Africa	0.99	0.99	0.99	0.99	1.01	1.01	1.00	1.01	0.98
South Asia	0.84	0.86	0.87	0.88	0.91	0.91	0.92	0.92	0.93
Of which India	0.84	0.86	0.88	0.89	0.91	0.92	0.92	0.93	0.93
Sub-Saharan Africa	0.72	0.70	0.70	0.68	0.69	0.70	0.70	0.72	0.73
Total	0.74	0.80	0.82	0.82	0.84	0.85	0.85	0.86	0.87
			(b) $2.00						
East Asia and Pacific	0.80	0.97	1.06	1.05	1.07	1.18	1.17	1.20	1.31
Of which China	0.79	0.98	1.09	1.03	1.07	1.19	1.17	1.19	1.33
Eastern Europe and Central Asia	1.55	1.56	1.57	1.51	1.38	1.37	1.31	1.29	1.25
Latin America and Caribbean	1.22	1.22	1.20	1.23	1.21	1.21	1.21	1.24	1.26
Middle East and North Africa	1.44	1.47	1.46	1.48	1.49	1.50	1.48	1.50	1.50
South Asia	1.05	1.10	1.11	1.14	1.19	1.18	1.20	1.20	1.22
Of which India	1.06	1.10	1.12	1.15	1.17	1.19	1.20	1.21	1.22
Sub-Saharan Africa	0.98	0.94	0.94	0.91	0.92	0.89	0.92	0.95	0.99
Total	0.94	1.03	1.08	1.08	1.11	1.14	1.15	1.16	1.21

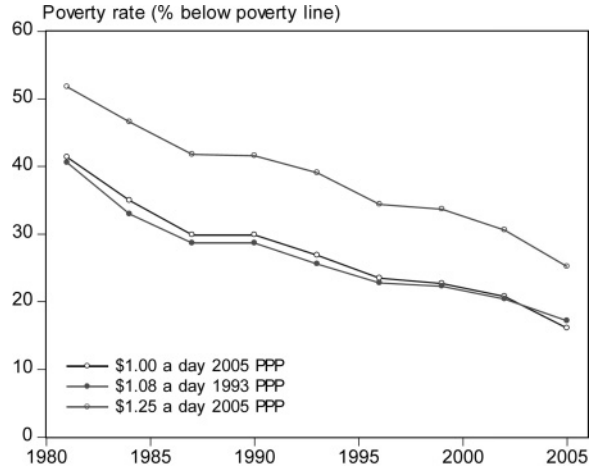

FIGURE IV
Poverty Rates Using Old and New Poverty Lines

of $0.87 (about 3.5% of global GDP per capita). The overall mean consumption of the poor tended to rise over time, from $0.74 per day in 1981 to $0.87 in 2005 by the $1.25 line, and from $0.94 to $1.21 for the $2 line. Over time, poverty has become shallower in the world as a whole.

The mean consumption of Africa's poor not only is lower than that for other regions, but also has shown very little increase over time (Table VI). The same persistence in the depth of poverty is evident in MENA and LAC, though the poor have slightly higher average levels of living in both regions. The mean consumption of EECA's poor has actually fallen since the 1990s, even though the overall poverty rate was falling.

VI. Comparisons with Past Estimates

Both the $1.25 and $1.45 lines indicate a substantially higher poverty count in 2005 than obtained using our old $1.08 line in 1993 prices; Figure IV compares the poverty rates estimated using the latter line with those obtained using either the $1.00- or $1.25-a-day lines at 2005 PPP. Focusing on the $1.25 line, we find that 25% of the developing world's population in 2005 is poor, versus 17% using the old line at 1993 PPP—representing an extra 400 million people living in poverty. (As can be seen in Figure IV, the series for $1.00 a day at 2005 PPP tracks closely that for $1.08 at 1993 PPP.)

It is notable that the conclusion that the global poverty count has risen is also confirmed if one does not update the nominal value of the 1993 poverty line (ignoring inflation in the United States). Using the $1.08 line for 2005, one obtains an aggregate poverty rate of 19% (1,026 million people) for 2005. The 2005 line that gives the same headcount index for 2005 as the $1.08 line at 1993 PPP turns out to be *lower*, at $1.03 a day. Although the adjustment for U.S. inflation clearly gives a poverty line for 2005 that is "too high," the 2005 line must presumably exceed the 1993 nominal line to have comparable purchasing power. So, as long as it is agreed that $1 in 1993 international prices is worth more than $1 at 2005 prices, the qualitative result that the new ICP round implies a higher global poverty count is robust.[44]

To help understand why we get a higher poverty count for a given year, it is instructive to decompose the total change into its various components. Recall that there are three ways in which the data have been revised: new PPPs, new national poverty lines, and new surveys. The last effect turns out to be small. When we use the new survey database for 2005 to estimate the poverty rate based on the 1993 PPPs and the old $1.08 line we get a headcount index of 17.6% (957.4 million people) instead of 17.2%. So we will focus on the effect of the other two aspects of the data, by evaluating everything using the new survey database.

Let z_t^n denote the new ("n") vector of national poverty lines (from RCS), evaluated at the PPPs for the ICP of round t, and let z_t^o be the corresponding vector of old ("o") poverty lines for the 1980s (from RDV). The international lines are $f(z_{05}^n) = \$1.25$ a day in 2005 prices and $f(z_{93}^o) = \$1.08$ a day in 1993 prices or $1.45 in 2005 prices adjusting for U.S. inflation. Next let y_t be a vector giving the distribution of consumption for the developing world in 2005 evaluated using ICP round t. Let $P(z_t^k, y_t)(k = o, n; t = 93, 05)$ be the poverty measure for 2005 (subsuming the function f). So $P(z_{93}^o, y_{93}) = 18\%$ and $P(z_{05}^n, y_{05}) = 25\%$.

Now consider the following exact decomposition:

$$P\left(z_{05}^n, y_{05}\right) - P\left(z_{93}^o, y_{93}\right) = A + B + C, \tag{1}$$

where $A \equiv P(z_{05}^n, y_{05}) - P(z_{93}^n, y_{05})$ is the partial effect of the PPP change via the international poverty line, holding the distribution

44. Deaton (2010) questions this claim by comparing an international line of $0.92 a day in 2005 prices with the old $1.08 line in 1993 prices. Yet the former line must have a lower real value.

and national poverty lines constant at their new values; $B \equiv P(z^n_{93}, y_{05}) - P(z^n_{93}, y_{93})$ is the partial effect of the change in distribution due to the change in PPPs; and $C \equiv P(z^n_{93}, y_{93}) - P(z^o_{93}, y_{93})$ is the partial effect of updating the data set on national poverty lines. Note that $A + B$ is the total effect (on both the poverty lines and the distribution) of the PPP revisions, holding the data on national poverty lines constant at their new values.

There are two counterfactual terms in the decomposition in (1), namely $P(z^n_{93}, y_{05})$ and $P(z^n_{93}, y_{93})$. To evaluate these terms we need to use the \$1.44-a-day line at 1993 PPP (Section III), rather than the \$1.08 line, which was based on the old RDV compilation of poverty lines. In applying this line to the 2005 distribution we need to update for U.S. inflation, giving $z^n_{93} = \$1.95$ in 2005 prices. We then obtain $P(z^n_{93}, y_{05}) = 46\%$ and $P(z^n_{93}, y_{93}) = 29\%$. Comparing these it can be seen that, holding the 1993 international poverty line constant (in real terms in the United States), the change in the PPPs added 17% to the poverty rate; this results from the higher cost of living in developing countries implied by the 2005 ICP results. (If instead one makes the comparison using the RDV data set on national poverty lines, one obtains $P(z^o_{93}, y_{05}) - P(z^o_{93}, y_{93}) = 14\%$.)

We find that the partial effect of the PPP revisions via the international poverty line is to bring the headcount index down substantially from 46% to 25% ($A = -21\%$). But there is a large and almost offsetting upward effect of the change in distribution ($B = 17\%$). On balance the net effect of the change in the PPPs is to bring the poverty rate down from 29% to 25% ($A + B = -4\%$). The fact that the PPP revisions on their own bring down the overall poverty count relative to a fixed set of national lines is not surprising, given that the poverty line is set at the mean of lines for the poorest countries *and* that the proportionate revisions to the PPPs tend to be greater for poorer countries. It can be shown that if the international poverty line is that of the poorest country, which also has the largest upward revision to its PPP, then the aggregate poverty rate will automatically fall, given that the national poverty lines are fixed in local currency units. The working paper version provides a proof of this claim (Chen and Ravallion 2009). Working against this downward effect of the new PPPs, there is an upward adjustment to the poverty count coming from the new data on national poverty lines, which (as we have seen in Figure II) tend to be higher for the poorest countries than those used by RDV for the 1980s. The updating of the data on

national poverty lines moved the global poverty rate from 18% to 29% ($C = 11\%$).

VII. Sensitivity to Other Methodological Choices

We have already seen how much impact the choice of poverty line has, though we have also noted that the qualitative comparisons over time are robust to the choice of line. In this section we consider sensitivity to two further aspects of our methodology: the first is our use of the PPP for aggregate household consumption and the second is our reliance on surveys for measuring average living standards.

VII.A. Alternative PPPs

The benchmark analysis has relied solely on the individual consumption PPPs ("P3s") from the ICP. One deficiency of these PPPs is that they are designed for national accounting purposes not poverty measurement. Deaton and Dupriez (DD) (2009) have estimated "PPPs for the poor" (P4s) for a subset of countries with the required data.[45] Constructing P4s requires reweighting the prices to accord with the consumption patterns of those living near the poverty line. Notice that there is a simultaneity in this problem, in that one cannot do the reweighting until one knows the poverty line, which requires the reweighted PPPs. Deaton and Dupriez (2009) implement an iterative solution to derive internally consistent P4s.[46] They do this for three price index methods, namely the country product dummy (CPD) method and both Fisher and Törnqvist versions of the EKS method used by the ICP.

The Deaton–Dupriez P4s cannot be calculated for all countries and they cannot cover the same consumption space as the P3s from the ICP. The limitation on country coverage stems from the fact that P4s require suitable household surveys, namely micro data from consumption expenditure surveys that can be mapped

45. The Asian Development Bank (2008) has taken the further step of implementing special price surveys for Asian countries to collect prices on qualities of selected items explicitly lower than those identified in the standard ICP. Using lower-quality goods essentially entails lowering the poverty line. In terms of the impact on the poverty counts for Asia in 2005, the ADB's method is equivalent to using a poverty line of about $1.20 a day by our methods. (This calculation is based on a log-linear interpolation between the relevant poverty lines.)

46. In general there is no guarantee that there is a unique solution for this method, although DD provide a seemingly plausible restriction on the Engel curves that ensures uniqueness. They also use an exact, one-step solution for the Törnqvist index under a specific parametric Engel curve.

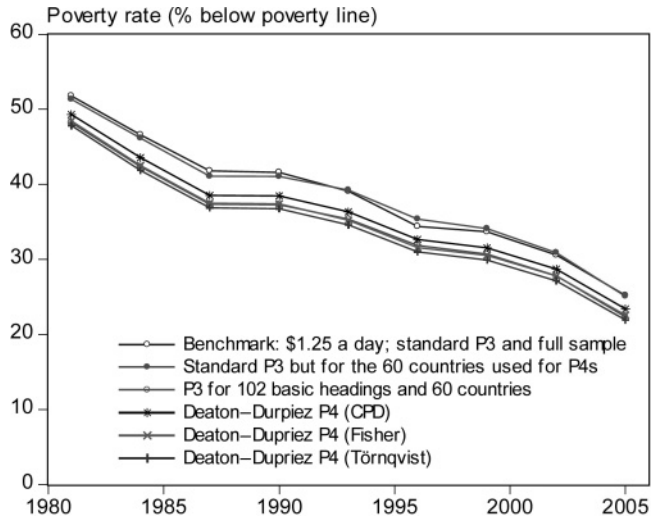

FIGURE V
Aggregate Poverty Rates over Time for Alternative PPPs

into the ICP "basic heading" categories for prices; the DD P4s are available for sixty countries, which is about half of our sample. The sixty-country sample is clearly not representative of the developing world as a whole and in some specific regions, notably EECA, where the population share covered by surveys in the sixty-country sample is only 8%, whereas overall coverage is 79%. As we will see, the sixty-country sample is poorer, in terms of the aggregate (population-weighted) poverty count. Also, some of the 110 basic headings for consumption in the ICP were dropped by DD in calculating their P4s. These included expenditures made on behalf of households by governments and nongovernmental organizations (such as on education and health care). Given that such expenditures are not typically included in household surveys, they cannot be included in DD's P4s. DD also preferred to exclude housing rentals from their calculations on the grounds that they were hard to measure and that different practices for imputing rentals for owner-occupied housing had been used by the official ICP in different countries. There are other (seemingly more minor) differences in how DD calculated their P4s and the methods used by the ICP.

Using the P4s at the country level kindly provided by Deaton and Dupriez, we have recalculated our global poverty measures.

TABLE VII
AGGREGATE POVERTY RATE AND REGIONAL PROFILE FOR 2005 UNDER ALTERNATIVE PPPS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PPP	P3	P3	P3	P3	P4: CPD	P4: Fisher	P4: Törnqvist
No. countries for poverty measures	115	115	60	60	60	60	60
No. countries for poverty line	15	15	14	14	14	14	14
Poverty line (per month)	$38.00	$33.34	$37.41	$32.88	Rs.576.86	Rs.557.00	Rs.547.83
No. basic headings	110	102	110	102	102	102	102
				Headcount index (% of population)			
East Asia and Pacific	16.8	13.4	16.1	12.9	13.2	12.7	12.5
Eastern Europe and Central Asia	3.7	3.75	7.1	8.1	4.8	4.1	4.6
Latin America and Caribbean	8.2	7.1	8.4	7.6	8.8	8.5	7.9
Middle East and North Africa	3.6	2.2	8.7	4.9	4.2	4.2	4.2
South Asia	40.3	35.1	39.1	34.0	37.9	35.6	34.0
Sub-Saharan Africa	50.9	50.4	49.9	49.6	50.4	50.9	49.8
Total (for sampled countries)	25.2	22.4	28.3	25.1	26.7	25.7	24.9

Note. The Deaton–Dupriez P4 calculations are only possible for about half the countries in the full sample, given that consumption expenditure surveys are required. Also, one country drops out of the reference group for calculating the poverty line. The poverty lines for column (5)–(7) P4s are Deaton–Dupriez "world rupees."

In all cases we recalculate the international poverty line under the new PPPs, as well as (of course) the poverty measures. Table VII gives the results by region for 2005, whereas Figure V plots the estimates by year. In both cases we give our benchmark estimates for the official ICP PPP for individual consumption using all 110 basic headings for consumption and results for the 102 basic headings comprising those that can be matched to surveys less the extra few categories that DD chose not to include. Because the sixteen countries used by DD did not include one of the fifteen countries in our reference group, the poverty line is recalculated for fourteen countries, giving a line of $1.23 a day ($37.41 per month). With the help of the World Bank's ICP team, we also recalculated the official P3s for consumption using the set of basic headings chosen by DD. Column (1) reproduces the estimates from Table III, whereas column (2) gives the corresponding estimates for the full sample of countries using P3s calibrated to the 102 basic headings used by DD. Columns (3) and (4) give the results corresponding to columns (1) and (2) using the sixty-country subsample used by DD. Columns (5)–(7) give our estimates of the poverty measures using the P4s from DD, for each of their three methods. We give (population-weighted) aggregate results for the sample countries.[47]

It can be seen from Table VII that the switch from 110 to 102 basic headings reduces the aggregate poverty measures by about three percentage points, whereas switching from the 115-country sample to the 60-country sample has the opposite effect, adding three points. The pure effect of switching from P3 to P4 is indicated by comparing column (4) with columns (5)–(7). This change has only a small impact using the EKS method (for either the Fischer or Törnqvist indices), though it has a slightly larger effect using the CPD method.

On balance, the aggregate poverty count turns out to be quite similar between the P4s and our main estimates using standard P3s on the full sample. If one assumes that the countries without household surveys have the regional average poverty rates, then the Fisher P4 gives a count of 1,402 million for the number of poor, whereas the CPD and Törnqvist P4s give counts of 1,454 and 1,359 million, respectively, as compared to 1,377 million using

47. Note that this is a slightly different aggregation method from our earlier results, which assumed that the sample was representative at regional level. That is clearly not plausible for the sixty-country sample used by DD. We have recalculated the aggregates for the 115-country sample under the same basis as for the 60-country sample.

standard P3s. The regional profile is also fairly robust, the main difference being lower poverty rates in EECA using P4s, although the poor representation of EECA countries in the sixty-country sample used by DD is clearly playing a role here. The reduction in coverage of consumption items makes a bigger difference, with a higher poverty count in the aggregate (28% for these sixty countries using the standard PPP, versus 25% using the PPP excluding housing), due mainly to higher poverty rates in East and South Asia when all 110 basic headings for consumption are included.

The trends are also similar (Figure V). This is not surprising given that, when the usual practice of doing the PPP conversion at only the benchmark year and then using national data sources over time is followed, the real growth rates and distributions at country level are unaffected.

VII.B. Mixing National Accounts and Surveys

Next we test sensitivity to using instead the geometric mean of the survey mean and its expected value given NAS consumption; as noted in Section IV, this can be given a Bayesian interpretation under certain assumptions. Table VIII gives the estimates implied by the geometric mean; in all other respects we follow the benchmark methodology. The expected value was formed by a separate regression at each reference year; a very good fit was obtained using a log-log specification (adding squared and cubed values of the log of NAS consumption per capita did little or nothing to increase the adjusted R^2).

In the aggregate for most years, and most regions, the level of poverty is lower using the mixed method than the survey-means only method. In the aggregate, the 2005 poverty rate is 18.6% (1,017 million people) using the geometric mean versus 25.2% (1,374 million) using unadjusted survey means. Nonetheless, the mixed method still gives a higher poverty rate for 2005 than implied by the 1993 PPPs. Using the $2.00 line, the 2005 poverty rate falls from 47.0% to 41.0%.

Figure VI compares the aggregate headcount indices for $1.25 a day between the benchmark and mixed method. The trend rate of poverty reduction is almost identical between the two, at about 1% per year. (Using the mixed method, the OLS trend is −0.98% per year, with a standard error of 0.04%, versus −0.99% with a standard error of 0.06% using only the survey means.) The linear projection to 2015 implies a poverty rate of 9.95% (s.e. = 1.02%), less than one-third of its 1990 value.

TABLE VIII
HEADCOUNT INDEX USING MIXED METHOD (%)

	1981	1984	1987	1990	1993	1996	1999	2002	2005
				(a) $1.25 a day					
East Asia and Pacific	67.1	57.4	49.4	48.5	40.6	28.4	26.5	20.3	12.1
Of which China	73.0	62.3	51.9	55.5	45.0	30.6	29.0	22.4	12.1
Europe and Central Asia	1.9	1.7	1.7	2.6	4.8	6.1	5.7	3.8	3.1
Latin America and Caribbean	13.9	16.3	16.7	18.0	15.0	15.8	14.0	15.3	9.8
Middle East and North Africa	7.6	6.5	6.4	5.0	5.0	5.4	5.4	4.4	4.4
South Asia	42.7	39.3	39.0	33.6	30.4	28.1	28.1	26.2	21.6
Of which India	42.3	38.7	38.0	32.2	30.4	26.4	26.4	25.1	20.3
Sub-Saharan Africa	51.9	54.0	53.7	55.6	55.9	56.5	56.9	55.3	51.0
Total	43.6	39.6	36.6	35.3	31.7	27.2	26.5	23.7	18.6
				(b) $2.00 a day					
East Asia and Pacific	89.8	86.0	81.4	78.6	73.0	59.6	56.2	46.6	34.0
Of which China	95.4	91.6	85.7	85.4	78.4	63.0	58.8	48.8	33.9
Europe and Central Asia	6.9	6.4	5.8	7.4	11.8	14.7	14.8	10.8	8.2
Latin America and Caribbean	26.5	30.3	29.2	31.8	28.2	29.3	26.4	28.7	19.6
Middle East and North Africa	26.7	24.4	24.0	20.7	20.5	20.7	19.8	17.5	15.8
South Asia	77.4	75.0	74.7	70.1	67.9	65.4	64.5	62.6	56.8
Of which India	77.0	74.6	74.2	69.3	68.4	64.2	63.9	62.4	57.0
Sub-Saharan Africa	73.1	74.8	74.2	75.2	75.2	76.6	76.9	76.0	73.4
Total	66.0	64.4	62.5	60.7	58.4	53.7	52.2	48.2	41.0

The mixed method gives a higher poverty rate for LAC and MENA and makes negligible difference for SSA. Other regions see a lower poverty rate. The $1.25-a-day rate for East Asia in 2005 falls from 17% to 12%. The largest change is for South Asia, where by 2005 the poverty rate for India falls to about 20% using the mixed method versus 42% using the unadjusted survey means; the proportionate gap was considerable lower in 1981 (42% using the mixed method versus 60% using the survey mean alone).

India accounts for a large share of the discrepancies between the levels of poverty between the benchmark and the mixed method, reflecting both the country's population weight and the large gap that has emerged in recent times between the survey-based and national accounts consumption aggregates for India. Figure VI also gives the complete series for $1.25 a day excluding India; it can be seen that the gap between the two methods narrows over time. If we focus on the poverty rates for the developing

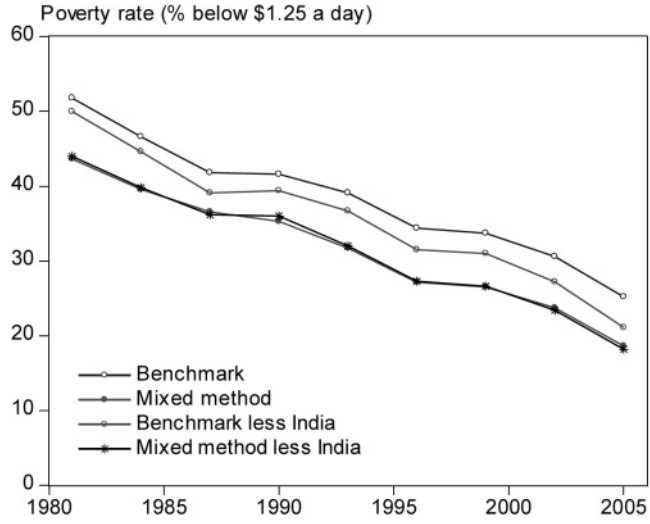

FIGURE VI
Aggregate Poverty Rates over Time for Benchmark and Mixed Method

world excluding India then the difference between the mixed method and the benchmark narrows considerably, from 21.1% (918 million people) to 18.2% (794 million) in 2005. (The $2.00 poverty rates are 39.8% and 36.7% respectively.) In 2005, about two-thirds of the drop in the count of the number of people living under $1.25 a day in moving from the benchmark to the mixed method is due to India.

VIII. CONCLUSIONS

Global poverty measurement combines data from virtually all branches of the statistical system. The measures reported here bring together national poverty lines, household surveys, census data, national accounts and both national and international price data. Inevitably there are comparability and consistency problems when combining data from such diverse sources. Price indices for cross-country comparisons do not always accord well with those used for intertemporal comparisons within countries. In some countries, the surveys give a different picture of average living standards to the national accounts, and the methods used in both surveys and national accounts differ across countries.

However, thanks to the efforts and support of governmental statistics offices and international agencies, and improved technologies, the available data on the three key ingredients in international poverty measurement—national poverty lines, representative samples of household consumption expenditures (or incomes) and data on prices—have improved greatly since global poverty monitoring began. The expansion of country-level poverty assessments since the early 1990s has greatly increased the data available on national poverty lines. Side-by-side with this, the country coverage of credible household survey data, suitable for measuring poverty, has improved markedly, the frequency of data has increased, public access to these data has improved, and the lags in data availability have been reduced appreciably. And with the substantial global effort that went into the 2005 *International Comparison Program* we are also in a better position to assure that the poverty lines used in different countries have similar purchasing power, so that two people living in different countries but with the same real standard of living are treated the same way. The results of the 2005 ICP imply a higher cost of living in developing countries than past ICP data have indicated; the "Penn effect" is still evident, but it has been overstated.

We have combined the new data on prices from the 2005 ICP and household surveys with a new compilation of national poverty lines, which updates (by fifteen years on average) the old national lines used to set the original $1-a-day line. Importantly, the new compilation of national lines is more representative of developing countries, given that the sample size is larger and it corrects the sample biases in the old data set. The pure effect of the PPP revisions is to bring the poverty count down but this is outweighed by the higher level of the national poverty lines in the poorest countries, as used to determine the international line.

Our new calculations using the 2005 ICP and new international poverty line of $1.25 a day imply that 25% of the population of the developing world, 1.4 billion people, were poor in 2005, which is 400 million more for that year 2005 than implied by our old international poverty line based on national lines for the 1980s and the 1993 ICP. In China alone, which had not previously participated officially in the ICP, the new PPP implies that an extra 10% of the population is living below our international poverty line. But the impact is not confined to China; there are upward revisions to our past estimates for all regions. The higher global count is in no small measure the result of correcting the sample

bias in the original compilation of national poverty lines used to set the old "$1-a-day" line.

Although there are a number of data and methodological issues that caution against comparisons across different sets of PPPs, it is notable that our poverty count for 2005 is quite robust to using alternative PPPs anchored to the consumption patterns of those living near the poverty line. Of course, different methods of determining the international poverty line give different poverty counts. If we use a line of $1.00 a day at 2005 PPP (almost exactly India's official poverty line) then we get a poverty rate of 16%—slightly under 900 million people—whereas if we use the median poverty line for all developing countries in our poverty-line sample, namely $2.00 a day, then the poverty rate rises to 50%, slightly more than two billion people.

As a further sensitivity test we have proposed a simple Bayesian method of mixing the data on consumption from the national accounts consumption with that from survey means, whereby the survey mean is replaced by the geometric mean of the survey mean and its predicted value based on prior national accounts data. This is justified only under potentially strong assumptions, notably that consumption is identically log-normally distributed between the (national-accounts-based) prior and the surveys. These assumptions can be questioned, but they do at least provide a clear basis for an alternative hybrid estimator. This gives a lower poverty count for 2005, namely 19% living below $1.25 a day rather than 25%. A large share of this gap—two-thirds of the drop in the count of the number of poor in switching to the mixed method—is due to India's (unusually large) discrepancy between consumption measured in the national accounts and that measured by surveys.

Although the new data suggest that the developing world is poorer than we thought, it has been no less successful in reducing the incidence of absolute poverty since the early 1980s. Indeed, the overall rate of progress against poverty is fairly similar to past estimates and robust to our various changes in methodology. The trend rate of global poverty reduction of 1% per year turns out to be slightly higher than we had estimated previously, due mainly to the higher weight on China's remarkable pace of poverty reduction. The trend is even higher if we use our Bayesian mixed-method. The developing world as a whole is clearly still on track to attaining the first Millennium Development Goal of halving the 1990s "extreme poverty" rate by 2015. China attained the

MDG early in the millennium, almost 15 years ahead of the target date.

However, the developing world outside China will not attain the MDG without a higher rate of poverty reduction than we have seen over 1981–2005. The persistently high incidence and depth of poverty in SSA are particularly notable. There are encouraging signs of progress in this region since the late 1990s, although lags in survey data availability and problems of comparability and coverage leave us unsure about how robust this will prove to be.

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