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Weakly Relative Poverty

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Abstract

Prevailing measures of relative poverty put an implausibly high weight on relative deprivation, such that measured poverty does not fall when all incomes grow at the same rate. This stems from the (implicit) assumption in past measures that very poor people incur a negligible cost of social inclusion. That assumption is inconsistent with evidence on the social roles of certain private expenditures in poor settings and with data on national poverty lines. The authors propose a new schedule of "weakly relative" lines that relax this assumption and estimate the implied poverty measures for 116 developing countries. The authors find that there is more relative poverty than past estimates have suggested. In 2005, one half of the population of the developing world lived in relative poverty, half of whom were absolutely poor. The total number of relatively poor rose over 1981–2005, despite falling numbers of absolutely poor. With sustained economic growth, the incidence of relative poverty becomes less responsive to further growth. Slower progress against relative poverty can thus be seen as the "other side of the coin" to success against absolute poverty.

This paper—a product of the Director's office and the Poverty and Inequality Team, Development Research Group—is part of a larger effort in the department to _____. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at _____@worldbank.org.

Weakly Relative Poverty

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1. Introduction

The methods used in practice to measure poverty have differed radically between rich and poor countries. Poverty in the developing world is typically measured using absolute lines, which aim to have the same real value at different dates and places. Virtually all developing countries use absolute lines, though with differing real values depending on prevailing views of what it means to be "poor." At the global level, the World Bank's widely-used "$1-a-day" line is absolute, in that it aims to have the same purchasing power in different countries and at different dates.[2] Using an absolute line, any standard measure of poverty will automatically fall when all incomes grow at the same rate (leaving relative inequality unchanged).[3]

Most OECD countries have taken a very different approach, whereby the poverty line is set as constant proportion—typically 40-60%—of the mean or median income.[4] This implies that an equi-proportionate increase in all incomes leaves the poverty rate unchanged.[5] We call this a strongly relative poverty measure. Some advocates of this approach have explicitly rejected the idea of an absolute poverty line, including Atkinson (1975) and Townsend (1979).[6]

The main argument made for using a poverty line set at a constant proportion of the mean is that it allows for what can be termed "costs of social inclusion."[7] The idea is that certain private expenditures have a social role in assuring that a person can maintain personal dignity

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[2] The original "$1-a-day" was proposed by Ravallion et al. (1991) in a background paper for World Bank (1990); the latest update is Ravallion et al. (2008).

[3] But "standard" we mean any measure that is homogeneous of degree zero between the mean and the poverty line for any given Lorenz curve. This holds for the headcount index, poverty gap index, and indeed the entire class of Foster-Greer-Thorbecke (1984) measures, as well as the Watts index and other measures.

[4] Examples for OECD countries include Smeeding et al. (1990), Atkinson (1998), Saunders and Smeeding (2002), Fouarge and Layte (2005), Eurostat (2005), Nolan (2007) and OECD (2008, Chapter 5). An exception is the official poverty line for the US, which is three times the cost of a subsistence food basket, as first proposed by Orshansky (1963). However, there has been considerable dissatisfaction with this line; for a review of the debates see Blank (2008). There has been some debate about whether the poverty measure should be anchored to the mean or the median (Saunders and Smeeding, 2002; Easton, 2002; de Mesnard, 2007); poverty lines set as a constant proportion of the median can have perverse properties when the Lorenz curve shifts (as shown by de Mesnard, 2007). This is a legitimate concern but is not germane to the present paper.

[5] Note also that, for a given Lorenz curve, the median is directly proportional to the mean (the constant of proportionality is $L'(0.5)$ where $L(p)$ is the Lorenz curve). Thus the strong relativity property also holds when the poverty line is a fixed proportion of the median.

[6] For example, Atkinson (1975, p.186) writes that: "It is misleading to suggest that poverty may be seen in terms of an absolute standard which may be applied to all countries and at all times….A poverty line is necessarily defined in relation to social conventions and the contemporary living standards of a particular society."

[7] Another common defense is that such poverty lines are more "comparable"; for example, UNDP (2005, p.334) writes that "To ensure comparability across high-income countries, most comparative databases…measure poverty on a relative basis." The sense of the term "comparable" is unclear when the poverty line's real value (by any agreed cost-of-living index) can be orders of magnitude larger in one date or country than another.

and participate in customary social activities. Famously, Adam Smith pointed to the social-inclusion role of a linen shirt in eighteenth century Europe:

> "A linen shirt, for example, is, strictly speaking, not a necessary of life. The Greeks and Romans lived, I suppose, very comfortably though they had no linen. But in the present times, through the greater part of Europe, a creditable day-labourer would be ashamed to appear in public without a linen shirt, the want of which would be supposed to denote that disgraceful degree of poverty which, it is presumed, nobody can well fall into without extreme bad conduct."

The social roles of certain forms of conspicuous consumption have been noted from research in poor countries. Anthropologists have often noted the social roles played by festivals, celebrations and communal feasts in traditional societies; see, for example, Geertz (1976) and Fuller (1999, Chapter 6). Rao (2002) documents the importance of celebrations to maintaining the social networks that are crucial to coping with poverty in rural India. And Banerjee and Duflo (2007) report seemingly high expenditures on celebrations and festivals by very poor people in survey data for a number of countries. Clothing can also serve a social role. Friedman (1990) describes how poor Congolese acquired clothing with a conspicuous "designer label," which he interpreted as status-seeking behavior. A field experiment by van Kempen (2004) revealed that poor people in Bolivia were willing to pay a premium for a designer label; the results suggested that "…a designer brand logo primarily serves as a symbolic expression of social identity for the poor, not as an extrinsic quality cue." (van Kempen, 2004, p.222).[8]

This paper provides relative poverty measures for the developing world, to complement the "$1-a-day" absolute measures. However, we argue that prevailing approaches to measuring relative poverty need to be re-thought. The key issue is that recognizing the social roles of private consumption in developing countries does not imply that we should use strongly relative poverty lines. While we might agree that relative considerations matter to assessments of poverty, at least above some level of mean income, it is hard to accept the proposition that the incidence of poverty rises when someone at the poverty line gains (say) 5% of her income but the overall mean increases by more than 5%. Strongly relative measures have shown seemingly perverse trends over time,[9] and are no less problematic in cross-section comparisons, such as between countries or between urban and rural areas.[10]

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[8] For a more general discussion of the social-symbolic roles that consumption can play see Khalil (2000).

[9] For example, the UNDP (2005, Box 3) (based on Nolan et al., 2005) showed how relative poverty measures for Ireland were rising despite higher absolute living standards for the poor; thus the UNDP (p. 334) warns that: "…when economic conditions change rapidly, relative poverty measures do not always present a complete picture of

The key assumption made by strongly relative measures is that the cost of inclusion is a constant proportion of mean income. That is hardly plausible. The social-inclusion needs of very poor people may well be low, but it is difficult to see why they would go to zero in the limit. Presumably a socially acceptable linen shirt would not have cost any less for the poorest person in eighteenth century Europe as for someone living at the poverty line. In poor settings, conspicuous forms of (quite humble) consumption are often needed for social inclusion. We have noted the identity value to poor people of clothing labels and the role played by celebrations in maintaining networks. While very poor people may be highly constrained in their spending on things that facilitate their inclusion, and so be more socially excluded, that does not mean that their social inclusion needs are negligible.

We propose instead a concept of weakly relative poverty in which the elasticity of the poverty line to the mean is positive above some level, but with unity as its upper bound. There are antecedents to this idea. The literature on social-subjective poverty lines—poverty lines based on responses to survey questions concerning the "minimum income to make ends meet" or perceived consumption adequacy[11]—has pointed to mean-income elasticities of the poverty line less than unity.[12] The proposals made by the 1995 panel of the National Research Council (NRC) for revising the official poverty line of the US would also be likely to generate poverty lines with a positive (though inter-temporally variable) elasticity less than unity.[13] Each of these approaches can be questioned.[14] However, most importantly for the present paper, these

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the ways that economic change affects people's lives." In another example, Easton (2002) argued that relative measures for New Zealand were deceptive in showed falling poverty despite lower levels of living for the poor.

[10] For example, OECD (2008, Chapter 5) reports the same poverty rate for the US as Mexico. To give another example, the methods used by the urban poverty line proposed by Osberg and Xu (2008) for China (set at half the median) is 2.4 times their rural line, or 1.7 times when deflated by the differential in absolute lines, anchored to cost-of-living differences facing the poor, for urban and rural China used by Ravallion and Chen (2007). The Osberg-Xu method suggests little difference in poverty incidence between urban and rural China, while the Ravallion-Chen method indicates far higher poverty measures in rural China.

[11] See, for example, Groedhart et al. (1977), Kapteyn, Kooreman and Willemse (1988) and Pradhan and Ravallion (2000).

[12] Hagenaars and van Praag (1985) estimate an elasticity of 0.51 for eight European countries. Kilpatrick (1973) estimated an elasticity of about 0.6 for subjective poverty lines in the US. Luttmer (2005) reports regressions for subjective welfare in the US that imply strong relativism, although Ravallion and Lokshin (2007) argue that such regressions are likely to over-estimate the size of the relative deprivation effect

[13] The panel recommended that US poverty lines should be anchored to median expenditures on food, clothing and shelter (Citro and Michael, 1995). Given that these goods tend to be necessities, they will have an elasticity with respect to mean income less than unity.

[14] For example, in the case of the proposal by the NRC panel it is unclear why concerns about relative poverty would apply only to necessities; it would seem more natural to assume that the income gradient in a poverty line stems from social inclusion needs that go beyond necessities in a country such as the US.

approaches are not operational for global poverty measurement. We need a schedule of weakly relative poverty lines with global applicability.

We calibrate the parameters of such a schedule to the observed relationship across countries between national poverty lines and mean consumption. Here we follow Atkinson and Bourguignon (2002) and Chen and Ravallion (2001), but we relax their (implicit) assumption (in common with other strongly relative poverty lines) that very poor people incur very low costs of social inclusion. We then estimate new measures of poverty using survey data for 116 countries; the latest survey rounds cover a total of 1.23 million randomly sampled households.

The following section discusses the arguments from the literature as to why, and how, one might measure relative poverty. Section 3 then describes key features of the data. Section 4 describes our schedule of weakly relative poverty lines, while section 5 presents our relative poverty measures for the developing world. Section 6 concludes.

2. Revisiting the theory of relative poverty lines

The intuitive appeal of a common standard is that two people with the same purchasing power over commodities at different dates or places are treated the same way, in that both are either poor or not poor. However, this can be in tension with perceptions on the ground. For example, the relevance of the $1-a-day line to many countries in Latin America and Eastern Europe (let alone OECD countries) is clearly questionable, although that need not diminish the interest in measuring poverty in the world as a whole by a common global standard. In growing developing countries (some now middle-income) it may also be the case that perceptions of what "poverty" means are evolving, becoming more generous as living standards rise in the society as a whole. Granted, it is not common to see official poverty lines in growing developing economies being revised in real terms, though it may well be the case that a (positive) minimum aggregate income gain to a low-income country is needed before upward pressure on the poverty line emerges (as shown in Ravallion et al., 1991). There can also be a strong political resistance to revising the poverty line.[15] The poverty line in China has not been revised upwards in real terms for over 20 years, despite a four-fold increase in mean income. This has led many

[15] See, for example, the discussion in Blank (2008) on why the official poverty line in the US has not been updated, despite considerable dissatisfaction with the old line, proposed in 1963 and only updated for inflation since.

observers to question the relevance of their poverty lines to current conditions.[16] The government of China is in the process of revising upwards the country's official poverty lines.[17]

Nor are the conceptual foundations of the absolutist approach beyond question. The emphasis on absolute poverty is justified if one accepts two axioms: subgroup additivity and subgroup anonymity (Ravallion, 2008). The first says that aggregate poverty is the sum of all individual levels of poverty in the population, implying that if poverty increases in any subgroup, and does not change for any other group, then aggregate poverty must increase.[18] The practice of poverty measurement has largely been confined to such additive measures.[19]

Less attention has been paid to subgroup anonymity, which says that moving a person between groups, with no absolute loss in her own real consumption, cannot increase aggregate poverty. In combination with additivity, this implies that we should use poverty lines that have a constant real value across subgroups (as demonstrated in Ravallion, 2008). However, anonymity precludes the possibility that a person's poverty depends on her income relative to a reference group. There are two ways such relative considerations have entered poverty assessments, which can be labeled "welfarist" and "non-welfarist". The former points to the influence of relative position on subjective well-being. This is sometimes called the theory of relative deprivation (RD), following Runciman (1966), although economists often refer to it as the "relative income hypothesis," following Duesenberry (1949). Some version of RD has often been invoked to explain observed behavior, though importance of RD has long been debated in economics.[20]

While early discussions were plagued by a lack of evidence on the existence of RD effects, we now have a large body of supportive evidence from both observational studies and experiments. Regressions for self-reported "satisfaction with life" or perceived economic welfare have found results that are broadly consistent with the idea of RD.[21] There is still scope for

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[16] See, for example, Osberg and Xu (2008).

[17] The Planning Commission of the Government of India is also revisiting the country's official poverty line.

[18] This is the "subgroup monotonicity axiom" of Foster and Shorrocks (1991).

[19] Examples include the widely used Foster-Greer-Thorbecke (1984) class of measures. Atkinson (1987) reviews other additive measures in the literature.

[20] See, for example, Becker's (1974) discussion of the differing views of Adam Smith and Thorstein Veblen concerning (in effect) the welfare relevance of RD. Famously, Easterlin (1974) used RD to explain why the proportion of people who think they are happy has not changed much over time in the US, despite economic growth. Other examples of the use of relativism to explain behavior can be found in Frank (1997), Oswald (1997), Fehr and Schmidt (1999), Walker and Smith (2001) and Hopkins (2008).

[21] Examples include van de Stadt et al., (1985), Clark and Oswald (1996), Solnick and Hemenway (1998), Pradhan and Ravallion (2000), Ravallion and Lokshin (2002, 2007), McBride (2001), Blanchflower and Oswald (2004), Kingdon and Knight (2007), Ferrer-i-Carbonell (2005), Luttmer (2005) and Fafchamps and Shilpi (2009).

debate; for example, there are reasons why the mean income of some identified reference group might be significant (with a negative sign) in such regressions even when RD is not in fact present (Ravallion, 2008).[22] Some experiments have also suggested that relative position matters to behavior.[23] And village studies using anthropological methods have also suggested that concerns about relative position might have salience in very poor settings.[24] There has been very little empirical research on whether very poor people care about RD; in one of the few exceptions, Ravallion and Lokshin (2007) found evidence for Malawi that, for very poor people, the positive externalities from having better-off friends and neighbors outweighed the negative externalities through RD, although this pattern reversed at sufficiently high income levels.

The welfarist interpretation of a relative poverty line argues that poverty should be seen as absolute in the space of "welfare" rather than the consumption or income space. If welfare depends on both own income and relative income—own income relative to mean income in the country of residence—then for a poverty line to be a money-metric of welfare it must be an increasing function of mean income (Ravallion, 2008). We might then accept a suitably revised version of the anonymity axiom in the welfare space. Given that the cost-of-living indices and equivalence scales used in absolute poverty measurement are typically motivated in theory by the notion of some reference level of welfare or "utility" (that anchors the price index of scale) it is a logical step to also introduce RD effects into a money-metric of utility.

To see what this implies, suppose that welfare depends on "own income" (Y) and "relative income" (Y/M) where M is the measure of central tendency (either the mean or median for the place of residence). Welfare is $V(Y, Y/M)$, which is taken to be smoothly non-decreasing in both Y and Y/M. The poverty line in income space is denoted Z and is defined implicitly by:

$$\overline{V} = V(Z,\ Z/M) \tag{1}$$

where $\overline{V}$ is fixed, interpreted as the poverty line in the welfare space. Letting η denote the elasticity of the monetary poverty line with respect to the mean, it is readily verified that:

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[22] This happens when the measurement error in using own income as an indicator of economic welfare includes a geographic effect, such as due to latent returns to local public goods or omitted local cost-of-living differences. Ravallion (2008a) points to this and other sources of bias in testing for RD by regressing satisfaction with life on own income and mean income in the area of residence. By collecting survey data on the respondents' own reference group, Ravallion and Lokshin (2007) confirm the presence of RD effects, though not for the poorest.

[23] See, for example, Fehr and Schmidt (1999) and Alpizar et al (2005).

[24] This has emerged in some village studies; see for example Rao (2001) in reference to the role of celebrations in village India.

$$\eta = \frac{1}{1 + M.MRS} \quad (0 \leq \eta \leq 1) \tag{2}$$

where *MRS* is the marginal rate of substitution of relative income for own income ($MRS = V_Y / V_{Y/M}$), interpretable as the weight on own income divided by that on relative income. If η=0 then relative income does not matter (its weight is zero and so the *MRS* goes to infinity), while η=1 implies that only relative income matters (zero weight on own income).

There are also non-welfarist interpretations of relative poverty lines. Sen (1983, 1985) has argued that "capabilities" should be seen as absolute; in the context of poverty measurement, this means that "…an absolute approach in the space of capabilities translates into a relative approach in the space of commodities" (Sen, 1983, p. 168). Following Atkinson and Bourguignon (2001) we can think of poverty as having both absolute and relative aspects in the income space. The former is a failure to attain basic consumption needs, with associated capabilities of being adequately nourished and clothed for meeting the physical needs of survival and normal activities. On top of this, a person must also satisfy certain social needs, which depend crucially on the prevailing living standards in the place of residence.

How might these ideas be implemented for the purpose of measuring global relative poverty? Atkinson and Bourguignon (AB) proposed a neat answer, whereby absolute and relative poverty lines can be encompassed within a common framework, based on two key capabilities: physical survival and social inclusion. Each capability has a corresponding poverty line, giving the absolute and relative lines. The AB proposal is that one should only be deemed "not poor" if one is not poor by both lines. Let Z^* be the minimum expenditure needed to assure that basic consumption needs are met, measured at PPP. The AB poverty line for country *i* is:

$$Z_i^{AB} = \max(Z^*, kM_i) \quad (0 < k < 1) \tag{3}$$

By visual inspection of the Ravallion et al. (1991) data set on national poverty lines, Atkinson and Bourguignon set $Z^* = \$1.00$ a day at 1985 PPP and *k*=0.37. Subsequently, Chen and Ravallion (2001) found that *k*=1/3 and $Z^* = \$1.08$ gave a better fit with the RDV poverty lines at 1993 PPP.

We point to two concerns with the AB formulation and the relative poverty measures based on it (including those in Chen and Ravallion, 2001, 2004). First, the AB schedule of relative poverty lines has an elasticity of unity for all $M_i > Z^* / k$. Thus an equal proportionate

increase in all levels of consumption leaves the poverty measures unchanged in all countries with $M_i > Z^* / k$. We can think of the more general model:

$$Z = \max[Z^*, \phi(M_i)] \quad (4)$$

where $\phi(.)$ is some increasing function. Then the unitary elasticity in the Atkinson-Bourguignon lines can be seen to stem from an (implicit) homogeneity assumption, namely that $\phi(0) = 0$ (in addition to linearity). As noted in the introduction, this assumption is surely implausible. While the costs of social-inclusion needs may be very low for very poor people, they are unlikely to vanish in the limit. Nor does the evidence on the importance of RD effects in well-off countries give much support to the strong relativity property. As noted in the introduction, subjective poverty lines for developed countries have not shown this property. The idea that distribution-neutral growth has no impact on the extent of poverty in new middle-income countries such as China would surely be very hard to accept (not least, we would conjecture, in China).

We propose instead the following weak relativity axiom: *If all incomes increase (decrease) by the same proportion then aggregate poverty measure must fall (rise).* In any standard (additive) poverty measure this will be satisfied as long as the elasticity of the poverty line to mean income does not exceed unity.

A second concern is that the Atkinson-Bourguignon formulation is hard to reconcile with how the data, to which they calibrated their schedule of poverty lines, were in fact generated. Most national poverty lines in the RDV data set are absolute lines, which are generally additive between different types of goods that make up the "poverty bundle." One can think of three categories of commodities: The first are basic consumption needs. These are the goods needed for the capability of physical survival: the food, clothing and shelter needed for personal survival, including maintaining the activity levels needed to acquire those goods. Secondly, there are social-inclusion needs. These are socially determined requirements for the capability of social functioning (including employment) in a specific society, such as being adequately clothed by prevailing norms. This set of commodities expands with economic development. In a very poor country, people can participate quite fully in the mainstream of social activity at modest consumption levels. As average income rises, so too does the cost of inclusion. Finally, there are luxuries, which are not necessary for social inclusion, and are also beyond basic consumption needs. The additive poverty line corresponding to the two essential capabilities identified by

Atkinson and Bourguignon would be the sum of the costs of basic-consumption needs and social-inclusion needs. In short, the line would be $Z^* + \phi(M_i)$ not $\max[Z^*, \phi(M_i)]$.

Both these concerns can be addressed, while preserving the neatness of the AB solution. On the first concern, we need to relax homogeneity, by choosing a functional form for $\phi(M_i)$ such that social inclusion needs have a positive lower bound ($\phi(0) > 0$). On the second issue, note first that it is implausible that basic consumption needs and social inclusion needs constitute disjoint (non-intersecting) sets. Some basic needs also help satisfy social needs and vice versa. Then adding Z^* and $\phi(M_i)$ would be double counting. In sufficiently poor societies, the social-inclusion needs are modest and arguably can be met with the same commodities required for assuring that basic consumption needs are attained. Only when average living standards rise above some level is it the case that the set of social-inclusion needs starts to include extra commodities that are not basic consumption needs. Note that we can still write the poverty lines in the form of equation (4), by the following interpretation of that equation:

$$Z = Z^* + \Psi(M_i) \tag{5}$$

where $\Psi(M_i)$ is the cost of the incremental social needs beyond basic consumption, i.e.,

$$\Psi(M_i) \equiv 0 \text{ if } M_i < \phi^{-1}(Z^*) \tag{6.1}$$

$$\Psi(M_i) \equiv \phi(M_i) - Z^* \text{ if } M_i \geq \phi^{-1}(Z^*) \tag{6.2}$$

The interpretation is slightly different to AB, but the essential idea is the same of an absolute poverty line dominating at low consumption levels but becoming a relative poverty line beyond some higher level. Most importantly, however, the strong relativity property is relaxed.

3. Data for measuring poverty in the developing world

We use three main data sources. The first is a new compilation of national poverty lines documented in Ravallion et al. (2008). This exploits the new analytic work on poverty at country level that has been done since 1990, when Ravallion et al. (1991) collected the data on national poverty lines used for setting the "$1-a-day" line (and by AB for setting their encompassing line). Much of the new work has been done under the World Bank's program of country *Poverty Assessments* and the program of *Poverty Reduction Strategy Papers* by national governments, often with assistance from the Bank or other governments or international agencies. There were

very few of these studies available in 1990, but they have now been done for some 100 developing countries. Almost all include estimates of national poverty lines.

Second, we use the 2005 round of the *International Comparison Program* (World Bank, 2008). This is the most ambitious round to date of the ICP (which began in 1968), and entailed a substantial improvement in data quality for estimating PPP's. For the purpose of measuring global poverty, an important feature of the 2005 ICP is that it did a much better job of collecting the prices needed to measure living costs. Reliable price surveys are quite difficult to do, particularly in poor countries where non-traded goods are a large share of spending. The new surveys done for the 2005 ICP used far more elaborate product descriptions to help identify comparable goods, so that we do not make the mistake of judging people to be better off because they consume lower quality (and hence cheaper) goods. There were other improvements, including better methods for valuing services from government.

Third, we use our compilation of 675 household surveys for 116 countries; Chen and Ravallion (2008a) provide a listing of the countries and years; further details can be found in the *PovcalNet* site. The surveys were mostly done by governmental statistics offices. We have estimated all poverty measures from the primary (unit record or tabulated) survey data. Households are ranked by either consumption or income per person; we have preferred consumption, which is available for about 60% of the surveys. 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 poverty line. Interpolation methods (described in Chen and Ravallion, 2004, 2008) are used to line up the survey-based estimates with the reference years at three-yearly intervals over 1981-2005.

Drawing on the first and second sources, Ravallion, Chen and Sangraula (RCS) (2008) compiled a data set on national poverty lines for 88 developing countries. Figure 1 plots the national poverty lines for developing countries compiled by RCS against private consumption per capita from the national accounts (denoted C_i). On the basis of these data, RCS proposed a new international poverty line of $1.25 a day at 2005 PPP for household consumption, which is the average poverty line amongst the poorest 15 countries.

Combined with the third data source, Chen and Ravallion (2008a) estimated poverty measures using the $1.25 line. Tables 1 and 2 summarize their results. It was found that 25 percent of the population of the developing world, 1.4 billion people, lived below $1.25 a day in

2005. Twenty-five years earlier (in 1981) the percentage was 52%. This rate of progress was sufficient to bring the count of the number of poor down from 1.9 billion to 1.4 billion (Table 2). However, progress was highly uneven, both over time and across regions. Outside China, the gains to the poor have roughly cancelled the losses, such that the total number of people living below $1.25 a day stayed at around 1.1-1.2 billion over the period 1981-2005.

Figure 1 reveals that the national poverty line tends to rise with mean consumption, which we call the "economic gradient." The least squares estimate of the elasticity of Z to C is 0.655 (with a t-ratio of 13.68, based on a robust standard error).[25] This is significantly less than unity (t=7.21). So these data are not consistent with strongly relative poverty in developing countries, but they are consistent with the weakly-relative poverty—a national poverty line that rises with mean consumption, but with an elasticity less than unity.

However, Figure 1 also suggests that the economic gradient only emerges once mean consumption is above a critical level. Figure 1 gives a nonparametric regression of the national poverty lines against log mean consumption.[26] So the same pattern found by RDV using their compilations of national poverty lines for the 1980s is evident in Figure 1, with the poverty line rising with mean consumption, but with a low elasticity initially.

Figure 1 motivates our proposed schedule of weakly relative poverty lines and measures. Before presenting the results, it is of interest to try to better understand why we observe the pattern in Figure 1 and what it implies for setting global relative poverty lines. It accords with common sense, and has been recognized in the literature on poverty measurement, that people at different levels of living tend to hold systematically different views about what "poverty" means.[27] The critical level of spending that a poor person would deem to be adequate in order to escape poverty is likely to be lower than the level a rich person would deem adequate to avoid becoming poor. One might reasonably expect a similar gradient to hold across countries. Poverty lines are often anchored to nutritional requirements, which tend to be similar between people in poor and rich countries. So differences in nutritional requirements are probably not the reason for the economic gradient in national poverty lines. More plausibly, as living standards rise generally, there is a change in the prevailing notions of what consumption needs should be met if one is to not be deemed "poor;" people are expected to be able to afford more expensive

[25] The estimate is also robust to outliers; a median quantile regression gave 0.647 (t=9.57).

[26] We use STATA's Locally Weighted Scatter Plot Smoothing method with the default bandwidth (0.8).

[27] See the references in the introduction to the literature on subjective poverty lines.

calories (more meat and vegetables and higher quality foodgrains), have more varied diets, and be better clothed and housed. RCS show that the elasticity of the food component of the poverty line to mean consumption is 0.47 (t=9.55), which is about half the value for the non-food component, for which the elasticity is 0.910 (t=8.97). The economic gradient in national poverty lines evident in Figure 1 is driven more by the gradient in the non-food component of the poverty lines, which accounts for about 60% of the overall elasticity.

4. Empirical implementation and implications

Fitting a kinked function to the data in Figure 1 is a non-standard problem. Here we use AB's eyeballing method, though we subject the choice to a battery of tests. $1.25 a day ($38 per month) appears to be a reasonable choice for Z^*; this is the average poverty line of the poorest 15 countries in Figure 1, although this choice is fairly robust to using different reference groups (Ravallion et al., 2008). However, the new data are not support the Atkinson-Bourguignon assumption that $\phi(0) = 0$. A better fit can be obtained by relaxing homogeneity to allow a positive intercept ($\phi(0) > 0$) and we choose $0.60. Linearity of the ϕ function does provide a good fit to the data, and in fact the gradient of 1:3 used by Chen and Ravallion (2001) is still justified.[28] So our proposed schedule of weakly relative poverty lines is (in $'s per day):

$$Z_i \equiv \max[\$1.25,\ \$0.60 + C_i / 3] = \$0.60 + \max[\$0.65, C_i / 3] \qquad (7)$$

The poverty line starts to rise at $C_i \geq \$1.95$ per day. Equation (7) fits the data on national poverty lines very well. There is a high correlation with the nonparametric regression function in Figure 1 (r=0.994) as well as with the data on national poverty lines (r=0.836). Equation (7) outperforms a wide range of smooth parametric functional forms (Ravallion et al., 2008). Indeed, remarkably, the standard error in predicting the national lines is actually lower using equation (7) than the nonparametric regression in Figure 1.[29] As a further test, we found that neither the fitted values from the nonparametric regression in Figure 1 nor a cubic polynomial in *C* significant when added to a regression of the national poverty lines on Z given by equation (7).[30]

[28] Statistically, the joint restriction on (2) performs extremely well (F(2.71)=0.014; prob=0.986).

[29] The standard deviation of the error is $36.13 for our poverty lines versus $36.55 for the fitted values. Of course, a sufficiently less smooth nonparametric regression would do better than our piece-wise linear model.

[30] The joint F test of the null that the three parameters in the cubic function of *C* are all zero in the regression of national poverty lines on *Z* given by equation (7) gave F(3,69)=0.14 (prob.=0.93) while the t-test on the coefficient on the fitted values when added to the same regression was t=0.44.

The bold unbroken line in Figure 2 gives our weakly-relative schedule in (7) as well as the corresponding AB schedule. In our data set of national poverty lines, Z_i varies from \$1.25 a day to \$8 a day.[31] The fact that the rising portion of our poverty lines in (7) is not homogeneous immediately implies that the elasticity of the poverty line to mean consumption is below unity throughout (the elasticity goes to unity in the limit, as consumption goes to infinity). The elasticity is zero at $C < \$1.95$ and then rises from 0.5 to close to 1.0 over the sample range. The consumption level at which the kink (above which the poverty line rises with the mean) occurred in the Chen Ravallion (2001) version of the AB schedule of relative poverty lines is appreciably higher than for our new schedule. For the Chen and Ravallion (2001) relative lines the kink was at a consumption level of \$3.24 per day at 1993 PPP, while the new schedule of relative poverty lines in equation (7) has a kink at \$1.95 a day at 2005 PPP. If we had instead chosen $\max(\$1.25, C_i/3)$ as the relative poverty line at 2005 PPP, the kink would be at a consumption level of \$3.75 a day instead of \$1.95. This reflects the fact that our weakly relative measures allow $\phi(0) > 0$, thus shifting up the schedule (Figure 2). There are 18 countries with *C* in the interval (\$1.95, \$3.75), i.e., there are an extra 18 countries in the segment where the absolute line is no longer binding.

So our new data on national poverty lines suggest that relative poverty is a more prominent concern than our past work suggested. This echoes our finding that the overall elasticity of the poverty line to the mean in our sample is quite high—less than unity but similar to some past estimates for developed countries.

What might we expect on *a priori* grounds about the trends over time in weakly relative poverty, as compared to the trends in absolute poverty documented by Chen and Ravallion (2008a)? That will depend in part on how the distribution of relative incomes evolves during the growth process. As a stylized fact, there is no correlation across countries between rates of growth and rates of change in a standard measure of relative inequality.[32] In other words,

[31] There are three special cases: China, India and Indonesia. For these countries, we have separate rural and urban distribution data from 1981 to 2005. In addition, for China and India we have separate rural and urban CPI over time. We treat the relative poverty line based on (7) as the national line for India and Indonesia, and then back out the rural and urban poverty lines using the urban-rural differentials in national lines. For China, the 2005 PPP is an urban PPP, so we set the urban relative poverty line as the national line, and adjust the rural relative poverty line down according to the ratio of urban to rural poverty lines (following Chen and Ravallion 2008b).

[32] Ferreira and Ravallion (2009) provide an overview of the evidence on this stylized fact. Note that there is however a strong positive correlation between growth rates and the changes in absolute inequality (Ravallion, 2004).

amongst developing countries, economic growth tends to be distribution-neutral on average.[33] While there are a number of caveats on the interpretation of this point (Ravallion, 2004), it does motivate a consideration of distribution-neutral growth as a benchmark case.

To see how the trend rates of reduction in the poverty rate (headcount index) will differ using our relative poverty measure under distribution-neutral growth, let $F_i(Z_i)$ denote the proportion of the population of country *i* living below our weakly relative poverty line, while $F_i(Z^*)$ is the corresponding poverty rate using the absolute line. Under a distribution-neutral growth process it is readily verified that the proprotionate rates of poverty reduction are:[34]

$$\frac{d\ln F_i(Z_i)}{dt} = \left[1 - \frac{d\ln Z_i}{d\ln C_i}\right].\frac{\partial \ln F_i(Z_i)}{\partial \ln C_i}.\frac{d\ln C_i}{dt} \text{ (for } Z_i > Z^*) \quad (8.1)$$

$$\frac{d\ln F_i(Z^*)}{dt} = \frac{\partial \ln F_i(Z^*)}{\partial \ln C_i}.\frac{d\ln C_i}{dt} \quad (8.2)$$

Here the partial elasticities with respect to growth, $\partial \ln F_i(Z_i)/\partial \ln C_i < 0$ and $\partial \ln F_i(Z^*)/\partial \ln C_i < 0$, hold both the poverty line and the Lorenz curve constant. Since the elasticity of our relative poverty line to mean consumption is bounded above by unity, it must be the case that the relative poverty rate will fall as long as the growth rate ($d\ln C_i/dt$) is positive. The absolute poverty rate will also fall with positive growth. Whether or not the relative poverty measure falls more slowly than the absolute measure depends on the relative size of the partial elasticities. This is an empirical issue. Ravallion (2009) shows that, for the developing world as a whole, the (absolute) elasticity falls monotonically as the poverty line increases over the range \$0.75 to \$13 a day, certainly encompassing the range of our relative poverty lines. Then relative poverty will fall at a slower rate than absolute poverty.

Furthermore, as absolute poverty falls with economic growth both the elasticity of the poverty line with respect to the mean ($d\ln Z_i/d\ln C_i$) and the partial elasticity ($\partial \ln F_i(Z_i)/\partial \ln C_i < 0$) will tend to fall. Thus the trend rate of reduction in relative poverty will tend to fall as absolute poverty falls. With population growth, after some point, the numbers of

[33] Growth can be distribution neutral within all countries, but not distribution neutral in the world as a whole, depending on how the rates of growth vary with initial mean incomes. Ravallion (2009) shows that the overall growth process in the developing world has not been distribution-neutral.

[34] We exploit the fact that $L_i'(F_i(Z_i)) = Z_i/C_i$ where *L* is the Lorenz curve. Thus $F_i(Z_i)$ is homogeneous of degree zero in Z_i and C_i, holding constant the Lorenz curve (and hence the function $L_i'(.)$).

relatively poor will be rising, while the numbers of absolutely poor are falling. As we will see, these predictions are borne out by the data.

5. Weakly relative poverty measures for the developing world

We present our results for 1981-2005 at three yearly intervals. Table 3 gives the mean poverty lines by region. (The mean lines do not figure in the analysis but are still of interest.) In all regions and all years, the mean is above $38 per month ($1.25 a day), implying that the RD component is generally dominant. (The $1.25 line is binding for about 20% of countries and years.) In 2005, the inter-regional differences in relative poverty lines range from $47 per month in Sub-Saharan Africa (SSA) to $155 per month in Eastern Europe and Central Asia (EECA). The relative poverty lines rise over time with economic growth; in East Asia the average line goes from about $40 per month in 1981 to over $60 per month in 2005.

The headcount indices of weakly relative poverty are found in Table 4; Table 5 gives the corresponding counts of the numbers of poor. We find that, through most of the 1990s, about half of the population of the developing world was relatively poor. The proportion has fallen over time, from 63% in 1981 to 53% in 1990 and 47% in 2005. But the decline was not continual; the aggregate incidence of relative poverty rose slightly in both the late 1980s and late 1990s. The trend rate of decline over the period as a whole is -0.56 percentage points per year (with a standard error of 0.10). Projecting this trend rate of decline over 1981-2005 forward to 2015, the proportion living in relative poverty would be 40.5% (standard error=2.4%).

The trend decline in the incidence of relative poverty has not been sufficient to reduce the number of poor by this measure, which rose from 2.3 billion to 2.6 billion over 1981-2005 (Table 5). The turning point appears to be around 1987.

Figure 3 shows the simultaneous rise in relative poverty and fall in absolute poverty. As one would expect, the proportion of the relatively poor that are also absolutely poor has fallen over time, given economic growth. In 1981, 82% of the relatively poor were absolutely poor; by 2005 the proportion had fallen to 53%.

South Asia saw the largest absolute increase in the number of relatively poor. Only two regions have seen falling numbers of relatively poor, namely East Asia and EECA. East Asia also experienced falling count of the absolutely poor (though with a more rapid pace of progress against absolute poverty), though EECA saw the count generally rising over time. However, the

reasons for falling counts of the relatively poor are very different between East Asia and EECA. In the case of East Asia, sustained economic growth reduced relative poverty despite the rising poverty line (Table 3) (and also despite upward pressure on inequality, notably in China). In the case of EECA, economic contraction in the 1990s, associated with the transition to a market economy, simultaneously increased the number of absolutely poor (Table 2) but reduced the (much larger) count of the relatively poor (Table 5).

Comparing Tables 1 and 4, we see changes in the regional profile of poverty, although it is notable that the two regions with the highest incidence of absolute poverty also have the highest relative poverty rate. In 2005, SSA had the highest incidence of absolute poverty, with South Asia in second place (Table 1), but South Asia emerges as the region with the highest incidence of relative poverty (Table 4), with SSA second. Latin America and the Caribbean (LAC) had the third highest relative poverty incidence, but came fourth in absolute poverty.

As expected, the share of global poverty in the better off regions rises using our relative poverty measure; the share of total poverty in EECA rises from 1.3% (Table 2) to 6.1% (Table 5); the share of LAC rises from 3.3% to 9.6% and the share of the Middle East and North Africa goes from 0.8% to 4.3%. The largest decline in share is for SSA, which falls from 28.4% to 16.4%; South Asia's share falls from 43.3% to 36.1%.

Also comparing Tables 1 and 4, we find that the aggregate headcount index of relative poverty for 2005 is 1.88 times the aggregate index of absolute poverty; in 2002, the ratio was 1.62. Compare these numbers to the corresponding ratios from Chen and Ravallion (2004), using their parameterization of the Atkinson-Bourguignon relative poverty lines; for the latest year in the Chen-Ravallion series (2001) the aggregate measure of relative poverty was 1.36 times the aggregate measure of absolute poverty. This upward revision in the extent of poverty reflects the aforementioned fact that our weakly relative measures imply that the economic gradient in poverty lines emerges at a lower level than was found using the AB poverty lines calibrated in the RDV data set.

Table 6 gives the poverty gap (PG) indices.[35] Trends over time and regional differences are similar to the headcount indices in Table 4. The overall pace of progress against poverty is higher using the PG index than the headcount measure; by 2005, the value of PG had fallen to

[35] The PG 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 non-poor as having zero poverty gaps.

64% of its 1981 value, as compared to 75% for the headcount index. This implies that the mean income of the relatively poor grew faster than the poverty line. One notable difference in the regional profile is that, after 1984, Sub-Saharan Africa overtakes East Asia as the region with the highest relative poverty, and stays ahead of all other regions, including Sough Asia (which had the highest headcount index of relative poverty from 1987 onwards).

6. Conclusions

Our weakly relative poverty lines place a natural upper bound on the weight attached to relative deprivation, namely that it cannot matter so much that measured poverty does not fall when all incomes increase by the same proportion. This is motivated by our assumption that the cost of social inclusion is non-negligible for very poor people; research by anthropologists, social psychologists, economists and others offers support for this assumption. Our poverty lines are based on a new compilation of national poverty lines, drawing on a vast amount of new poverty studies since the 1980s. A simple, data-consistent, schedule of relative poverty lines is shown to provide an excellent fit to these data on national lines, but with an elasticity that rises from zero to unity, but never reaches unity.

On implementing our weakly relative poverty lines using almost 700 surveys for 116 countries we find that there is more relative poverty in the developing world than has been thought and that the pace of progress against relative poverty over 1981-2005 is less encouraging than that against absolute poverty. We find that 47% of the population of the developing world lived in relative poverty in 2005, down from 53% in 1990 and 63% in 1981. This was not a sufficient rate of decline in the incidence of poverty to prevent a rise in the number of poor, in contrast to our absolute poverty measures that show falling poverty counts in the aggregate. With economic growth, the relative poverty line tends to rise, and proportionately more as average income rises. Both the direct impact on the poverty line and the effect on the responsiveness of the poverty rate to economic growth tend to bring down the trend rate of decline in relative poverty. High growth rates in East Asia were sufficient to bring down the number of relatively poor, despite the rising relative poverty line. That was not so in most other regions.

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Figure 1: National poverty lines plotted against mean consumption

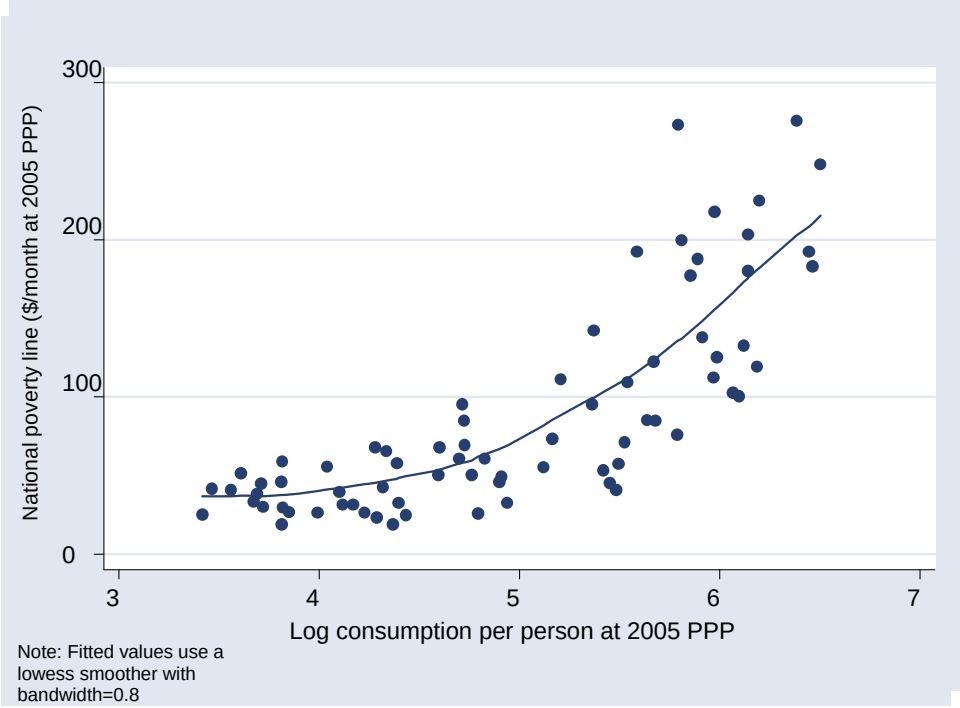

Figure 2: Weakly relative poverty lines

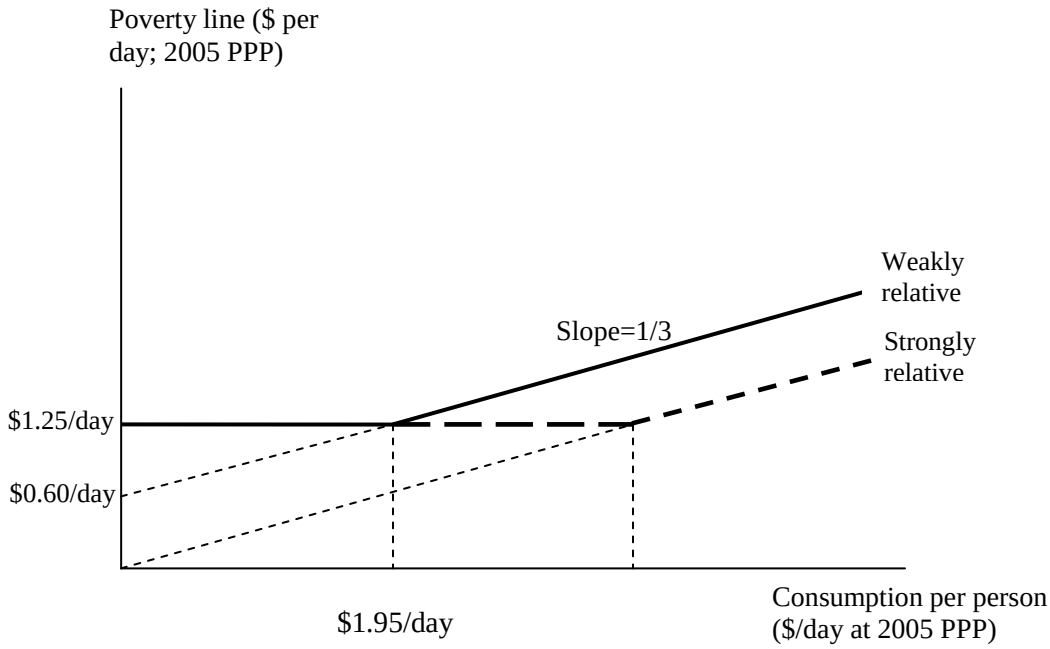

Figure 3: Numbers of absolutely poor and relatively poor

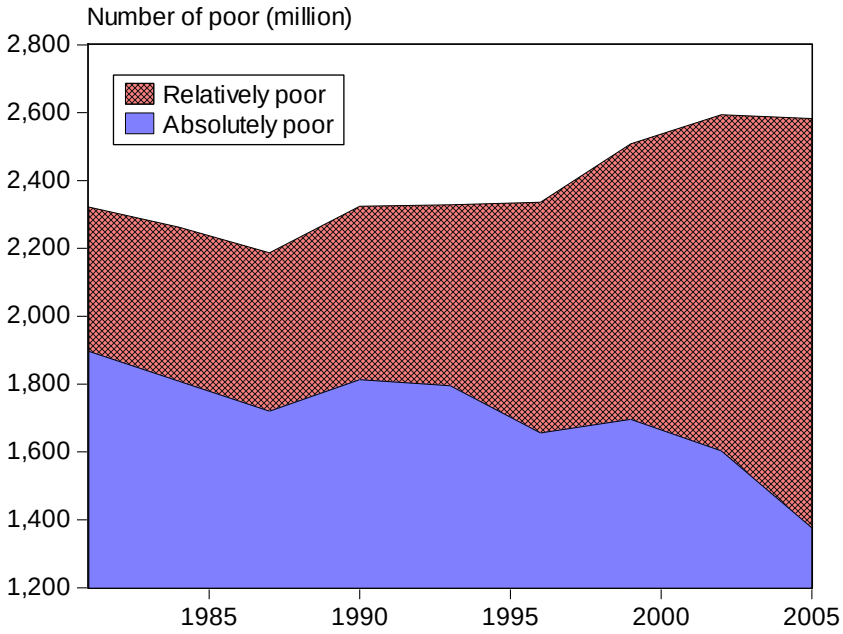

Table 1: Headcount index of absolute poverty by region using the $1.25 a day line

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
East Asia and Pacific	77.7	65.5	54.2	54.7	50.8	36.0	35.5	27.6	16.8
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	12.9	15.3	13.7	11.3	10.1	10.9	10.9	10.7	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
Sub-Saharan Africa	53.4	55.8	54.5	57.6	56.9	58.8	58.4	55.0	50.9
Total	**51.9**	**46.7**	**41.9**	**41.7**	**39.2**	**34.5**	**33.7**	**30.5**	**25.2**

Note: The table gives the % of the estimated population living in households with consumption per person below $38 per month at 2005 PPP.
Source: Chen and Ravallion (2008a).

Table 2: Number of absolutely poor by region using the $1.25 a day line

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005	2005
					Number in millions					%
East Asia and Pacific	1071.5	947.3	822.4	873.3	845.3	622.3	635.1	506.8	316.2	23.0
Eastern Europe and Central Asia	7.1	5.7	4.8	9.1	20.1	21.8	24.3	21.7	17.3	1.3
Latin America and Caribbean	47.1	59.5	56.7	49.6	46.6	53.1	55.3	56.6	45.3	3.3
Middle East and North Africa	13.7	11.6	11.9	9.7	9.9	10.6	11.5	10.3	11.0	0.8
South Asia	548.3	547.6	569.1	579.2	559.4	594.4	588.9	615.9	595.6	43.3
Sub-Saharan Africa	212.3	242.2	258.0	297.5	317.4	355.6	382.7	389.8	388.4	28.4
Total	**1899.8**	**1813.8**	**1722.8**	**1818.5**	**1798.6**	**1657.7**	**1697.7**	**1601.1**	**1373.7**	**100.0**

Note: Estimated number of people in millions living in households with consumption per person below $38 per month at 2005 PPP.
Source: Chen and Ravallion (2008a).

Table 3: Average poverty line ($PPP per person per month)

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
East Asia	39.81	40.03	40.09	41.47	42.53	44.48	47.54	52.93	60.98
Eastern Europe and Central Asia	135.72	140.40	144.84	140.84	122.01	114.32	114.56	127.53	155.45
Latin America and Caribbean	144.19	140.19	138.78	122.09	123.02	133.36	135.61	137.73	147.78
Middle East and North Africa	73.19	76.03	71.06	71.61	73.15	73.92	79.31	86.29	93.76
South Asia	39.16	39.49	39.93	41.75	42.52	44.85	45.97	47.71	51.52
Sub-Saharan Africa	47.49	47.41	45.51	45.43	44.78	45.61	45.74	46.12	46.91
Total	**63.58**	**63.80**	**63.71**	**62.27**	**60.78**	**62.24**	**63.87**	**67.85**	**75.41**

Source: Authors' calculations.

Table 4: Headcount index of relative poverty by region

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
East Asia	79.4	67.4	56.2	58.3	55.4	42.9	47.1	44.4	37.7
Eastern Europe and Central Asia	41.4	40.5	40.1	35.1	28.4	31.0	31.8	31.7	33.2
Latin America and Caribbean	52.5	55.5	50.1	43.3	43.4	48.9	48.6	49.5	45.1
Middle East and North Africa	32.5	29.4	28.4	26.9	27.3	29.3	30.5	33.8	36.6
South Asia	61.6	58.4	57.8	59.0	55.9	60.2	59.0	61.3	63.2
Sub-Saharan Africa	59.0	60.7	59.1	62.0	60.9	63.6	63.0	59.5	55.6
Total	**63.4**	**58.3**	**53.2**	**53.3**	**50.7**	**48.8**	**50.1**	**49.8**	**47.4**

Source: Authors' calculations.

Table 5: Number of relatively poor by region

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005	2005
					Number in millions					%
East Asia	1095.5	975.3	853.0	930.0	922.5	741.6	842.7	815.6	709.5	27.5
Eastern Europe and Central Asia	174.8	176.2	179.5	163.7	133.6	146.2	150.3	150.1	157.0	6.1
Latin America and Caribbean	191.9	216.6	207.7	189.5	200.3	237.1	246.7	262.2	248.1	9.6
Middle East and North Africa	56.4	55.8	59.0	60.8	66.1	75.5	83.5	97.8	111.7	4.3
South Asia	568.6	575.4	607.6	660.4	665.8	760.7	786.8	861.8	932.5	36.1
Sub-Saharan Africa	234.5	263.4	279.9	320.1	339.6	384.8	412.9	421.6	424.2	16.4
Total	**2321.7**	**2262.7**	**2186.8**	**2324.4**	**2328.0**	**2345.9**	**2522.8**	**2609.1**	**2583.1**	**100.0**

Source: Authors' calculations.

Table 6: Poverty gap index (x100) of relative poverty by region

Region	1981	1984	1987	1990	1993	1996	1999	2002	2005
East Asia	36.3	25.1	19.7	19.8	18.6	13.7	16.5	15.7	12.6
Eastern Europe and Central Asia	13.9	13.5	13.3	12.2	10.5	11.1	10.2	10.0	10.9
Latin America and Caribbean	25.7	27.9	24.4	19.6	19.3	23.0	23.0	23.4	20.2
Middle East and North Africa	9.9	8.6	8.1	7.4	7.3	7.8	8.3	9.6	10.8
South Asia	20.7	18.9	18.2	18.7	16.8	18.8	18.5	19.7	21.0
Sub-Saharan Africa	26.9	28.6	27.2	29.3	28.3	29.1	28.9	26.4	23.8
Total	**26.4**	**22.1**	**19.4**	**19.2**	**18.0**	**17.4**	**18.2**	**18.1**	**16.9**

Source: Authors' calculations.