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A Decomposition of Poverty Trends across Regions

The Role of Variation in the Income
and Inequality Elasticities of Poverty

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Abstract

The impact of globalization on global and local inequality is hotly debated in the recent literature. This study considers the separate issue of the impact of globalization on poverty through quantifying explicitly the responsiveness of poverty to aggregate changes in income distribution. We illustrate the quantitative importance of such an approach through decomposing poverty trends observed in the six major developing regions over the period 1980-98 under the assumption of a log-normal income distribution. We find that differential income growth accounts for most of the diversity in poverty trends, both across regions and over time, but leaves a substantial amount of variation unexplained. The impact of changes in inequality is relatively small, except in Eastern Europe and Central Asia. Income and inequality elasticities of poverty change

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over time in most regions, but more importantly, vary considerably across regions. We show that this cross-regional variation in elasticities can account for the bulk of the regional diversity in poverty trends that income growth does not account for.

The relevance of these findings for policymakers concerned with the impact of globalization on the world's poor is that globalization-induced average income and inequality changes will vary greatly in their impact on poverty depending on poverty's responsiveness to these changes, which in turn depends on the current distribution of income.

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1 Introduction

The call for the eradication of poverty is stronger now than ever before. The World Bank, the IMF, the UN and in particular UNDP, all development banks and nearly all multilateral and bilateral aid agencies profess themselves to be principally concerned with reducing the number and proportion of people who live in conditions of absolute poverty. However, in the case of some of the organizations mentioned, the professed concern with poverty reduction has not made much difference to their policy recommendations. Despite poverty reduction being the central objective, the principal focus of the policies that are pursued in the name of poverty reduction is on promoting economic growth. Poverty reduction is more popular than ever, but so is economic growth, with the difference that growth is no longer seen as an end but as a means to an end, succinctly expressed in the title of Dollar and Kraay (2002), 'growth is good for the poor'.

If economic growth is the 'royal avenue' for reducing poverty, international trade is seen to be the royal avenue for promoting growth (e.g., Dollar and Kraay 2003, 2004). Policies of deregulating internal markets, providing macroeconomic stability, encouraging private investment through a stable and transparent legal framework, and of course removing barriers to international trade, are recommended as part of the attempt to integrate a local economy into the global economy so that it benefits optimally from this integration. The dominant view on the impact of globalization on the poor can be summed up as: trade is good for growth and growth is good for the poor.

The exclusive focus on growth for pursuing poverty reduction, itself pursued through an unreflective advocacy of the supposed prosperity-enhancing impact of globalization, has worried more than a few commentators, particularly among NGOs. Two major concerns have been most forcefully expressed (cf. Jomo 2003). One is that globalization will promote income growth only in some regions, not in others. In other words, globalization will increase global inequality. A second concern is that even in regions where globalization does promote income growth, the poor will be left behind. In other words, globalization will increase local inequality. Globalization is thus held responsible for increasing both between-region and within-region inequality. The quality of the evidence for and against this assertion is hotly debated and it may be some time before the dust settles (contrast e.g., Rodriguez and Rodrik 2000 with Lee, Ricci and Rigobon 2004).

There exists, however, a third concern—arguably as important as the other two—that has received relatively little attention. The impact of globalization on income growth and inequality is a bone of contention, but even supposing that we knew this impact precisely, could we then decisively settle the issue of the impact of globalization on the poor? In other words, is it possible to *predict* the impact of trade-induced income growth and inequality changes on poverty? That is the central question of this study. The answer, in our view, is a qualified yes: it is possible to predict with a considerable degree of accuracy the impact of trade-induced income growth and changes in inequality on poverty by studying features of the *current* distribution of income. An important caveat is that the evidence that this study provides in support of this assertion implies that the responsiveness of poverty to trade-induced income growth and changes in inequality varies widely across regions and (to a lesser extent) over

time, exactly in line with variation in features of the distribution of income that is in place at the onset of these trade-induced changes.

This study provides evidence in support of these claims through a detailed examination of the role of variation in the income and inequality elasticities of poverty, both over time and across the six major developing regions: East Asia, Eastern Europe and Central Asia, Central and Latin America, Middle East and North Africa, South Asia, and Sub-Saharan Africa. The immediate aim is to shed light on the casual empiricism that contends that the poor appear to benefit much more from income growth, and suffer much more from rising inequality, in some situations than in others (e.g., Besley and Burgess 2003). For example, a given amount of growth appears to reduce poverty by more than twice as much in East Asia than in Sub-Saharan Africa, a region which, therefore, seems doubly cursed, both by low levels of growth and by a low responsiveness of poverty to growth. Paradoxically, in Eastern Europe and Central Asia, as the Gini index of inequality soared to unprecedented heights throughout the 1990s, each extra unit of increase of this index (naturally, controlling for changes in mean income) appears to add an ever *smaller* number of people to the growing legion of those with an income below two dollars per day. The proximate causes of poverty changes—changes in mean income and inequality—appear to work out very differently depending on when and where they occur.

In order to make rigorous sense of these casual observations, this study builds on two strands of the research literature on proximate causes of poverty changes. The first strand is the literature pioneered by Ravallion (1997), who shows that, other things equal, higher inequality of income at the onset of an episode of income growth *reduces* the extent to which the (absolute) poor benefit from that income growth. The finding that high inequality reduces the prospects for pro-poor growth has since been confirmed many times (e.g., Hanmer and Naschold 2000; Ravallion 2001; Mosley, Hudson and Verschoor 2004), but was left, as it were, hanging in mid air until the studies of Bourguignon (2003) and Epaulard (2003). Starting from the common-sense observation that poverty, mean income and inequality are related aspects of one income distribution, they show that the relationship between their changes depends *entirely* on properties of the initial income distribution (both mean income and inequality), which therefore need explicitly to be taken into account when examining the responsiveness of poverty to changes in mean income or income inequality.

This study also builds on the studies that decompose poverty changes into an effect due to changes in mean income and an effect due to changes in inequality. Studies that pioneered such a decomposition of poverty changes, using a parametric specification of the Lorenz curve, are Ravallion and Huppi (1991) for Indonesia, Datt and Ravallion (1992) for regions of Brazil and India, and Kakwani (1993) for Côte d'Ivoire. The decomposition methodology introduced in Datt and Ravallion (1992) has become very influential, sparking off a voluminous literature that applies their methodology.[1] Recent applications of their methodology make use of kernel

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[1] Contreras (2003) for Chile; Bigsten *et al.* (2003) for Ethiopia; Alwang *et al.* (2002) for Zimbabwe, and Gibson (2000) for Papua New Guinea are but a handful of recent examples that apply Datt and Ravallion's decomposition methodology to poverty changes in other contexts The decomposition proposed by Datt and Ravallion is not exact, i.e., a residual change in poverty is left unexplained,

smoothing techniques instead of parametric specifications of the Lorenz curve, with potentially large gains in accuracy (Contreras 2003; Alwang, Mills and Taruvinga 2002). In the concluding section of this paper, we return to the significance of this literature for policymakers concerned with the impact of globalization on the world's poor.

In the methodological section (section 2) we take Bourguignon (2003) and Epaulard (2003) as our point of departure to show how the responsiveness (elasticity) of poverty to income growth and changes in inequality can be readily calculated when assuming a log-normal income distribution. We next show how based on a first-order approximation, a Datt and Ravallion-style decomposition of poverty changes across regions and over time can be obtained based on changes in mean income and inequality and the income and inequality elasticities of poverty.

In the empirical section we use unbalanced panel data containing information for 76 developing countries over the period 1981-98. We use these data to construct for each of the six regions weighted averages over time of poverty, mean income and income inequality (section 3). Based on these regional averages, we analytically derive the income and Gini elasticies of poverty by region and show that these vary considerably across regions (section 4.1). For example, for 1990 we find an income elasticity of poverty equal to -1.06 on average, ranging from -0.47 for South Asia to -4.21 for Eastern Europe and Central Asia. These values differ considerably from the 'universal' growth elasticity of -2 that Collier and Dollar (2001, 2002) use in their influential policy simulations. We find a Gini elasticity of poverty equal to 0.21 on average, ranging from -0.06 in South Asia to 2.94 in Eastern Europe and Central Asia. We also find evidence for variation over time, but this appears quantitatively less important.

The analytically derived elasticities form the inputs for our decomposition of regional poverty trends during the 1980s and 1990s (section 4.2). Using our calculated region specific elasticities, we find that income changes account for most of the variation in poverty trends across regions and over time and that the impact of changes in inequality is relatively small, except in Eastern Europe and Central Asia. The impact of changes in the income and inequality elasticies of poverty over time is also relatively small, except again in Eastern Europe and Central Asia, but the variation in these elasticities across regions is large and, consequently, accounts for a substantial part of observed regional variation in poverty trends.

A comparison of our predictions with those implied by assuming an income elasticity of poverty equal to -2, as in Collier and Dollar (2001, 2002), show that using the latter elasticity consistently overestimates the amount of poverty reduction during the 1980s and 1990s (by a factor two when we pool all regions). Collier and Dollar (2001) examine whether the Millennium Development Goal (MDG) of halving global poverty can be met through the use of poverty-efficient aid. They conclude that it can be met. In the light of the poor within-sample performance of their elasticity, it is perhaps not advisable to use it for out-of-sample poverty projections, and it may yet

and, as an alternative, Kolenikov and Shorrocks (2005) propose an exact poverty decomposition, which they apply to regions in Russia, taking also into account changes in local prices.

be too early to start celebrations insofar as this particular MDG is concerned, even if policymakers were to follow Collier and Dollar's aid-allocation rule.

Section 5 concludes with the observation that the relevance of the two strands of the literature discussed above for policymakers concerned with the impact of globalization on the world's poor cannot be overstated: whether or not globalization will be *equitable* in its consequences depends to a considerable extent on the shape and the location (i.e., current mean income) of the distribution of income that these consequences impact on. Moreover, poverty's responsiveness to the immediate effects of globalization can be quantified *before* these effects materialize. A detailed study of the current distribution of income therefore has tremendous potential payoffs for increasing our understanding of the impact of globalization on the world's poor: it provides a very powerful handle indeed on the tricky matter of the degree in which the poor will benefit from globalization-induced changes in average prosperity and the distribution thereof.

2 Income and inequality elasticities of poverty and decomposition methodology

In section 2.1 we formalize how changes in a poverty headcount measure relate to changes in mean income and the Gini index of inequality. In section 2.2, following Bourguignon (2003) and Epaulard (2003), we analytically derive the income and Gini elasticities of poverty. By assuming income to be log-normally distributed, one can compute unit-specific elasticities of poverty with respect to changes in mean income and Gini. They show that such 'theoretical' values predict changes in poverty reasonably well and considerably better than *ad hoc* econometric specifications. In section 2.3 we outline how we decompose regional poverty trends into effects due to changes in mean income and inequality and due to variation in the income and inequality elasticities of poverty.

2.1 Poverty, income and inequality

Our measure of poverty is the proportion of the population at time t with an income below the absolute poverty line z, which is equal to the probability that income Y_t is lower than the poverty line:

$$H_t = \Pr(Y_t < z) \equiv F_t(z) .$$
(1)

$F_t(.)$ is the distribution function of income. Following Bourguignon (2003) and Epaulard (2003), we assume a log-normal income distribution and in this case poverty is expressed as follows:

$$H_t = \Phi\left(\frac{\log(z/\mu_t)}{\sigma_t} + \frac{1}{2}\sigma_t \right),$$
(2)

where $\Phi(.)$ is the cumulative distribution function of the standard normal distribution, which is denoted by $\phi(.)$. The standard deviation of the logarithm of income is denoted by σ_t and μ_t is mean income. Gini in period t, denoted by G_t, is now given by:

$$G_t = 2\Phi\left(\frac{\sigma_t}{\sqrt{2}}\right) - 1. \tag{3}$$

Using a first-order approximation, we can decompose the relative change in poverty over time into an income growth and a redistribution effect:

$$\frac{dH_t}{dt} = \frac{\partial H_t}{\partial \mu_t}\frac{d\mu_t}{dt} + \frac{\partial H_t}{\partial G_t}\frac{dG_t}{dt} + \xi_t. \tag{4}$$

In terms of elasticities we can rewrite Eq. (4) as follows:

$$\frac{dH_t}{dt} = \varepsilon_\mu^H \frac{d\mu_t}{dt}\frac{H_t}{\mu_t} + \varepsilon_G^H \frac{dG_t}{dt}\frac{H_t}{G_t} + \zeta_t, \tag{4'}$$

where ε_μ^H denotes the (distribution-neutral) income elasticity of poverty and ε_G^H the Gini elasticity of poverty. ζ_t is a residual, indicating that a first-order approximation is used and that we do not consider second-order effects.

Figure 1 illustrates the decomposition by considering a move from an initial to a final log-normal distribution in two stages: by first shifting its mean and next its dispersion parameter.[2] The initial distribution shifts to the right so that its mean is identical to that of the final distribution but at first it does not change shape: the *relative* distribution remains unchanged. The area between the two identically shaped distributions to the left of the poverty line is the poverty reduction that results from the growth that has actually taken place, under the assumption that the relative distribution of income has not changed. The final distribution has a different shape from the initial distribution—the relative distribution *has* changed; in Figure 1 we illustrate for decreasing inequality. The area between the shifted initial and the final distribution is the poverty reduction resulting from a changing Gini.

The impact on a poverty headcount ratio of changes in mean income and Gini depends on the shape and the location of the initial distribution of income. In a carefully selected example, this can be readily seen. Figure 2 illustrates the income elasticity of poverty. An identically-sized spread-preserving shift *B* of mean income implies a much larger poverty headcount change for a distribution such as the one illustrated in the top panel of the figure than the one illustrated in the bottom panel. However, the influence of the initial distribution of income on Gini and income elasticities of poverty is not always so obvious, and below we provide an analytical derivation of these elasticities.

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[2] The figure has been used by a number of authors; our direct source is Bourguignon (2003).

Figure 1
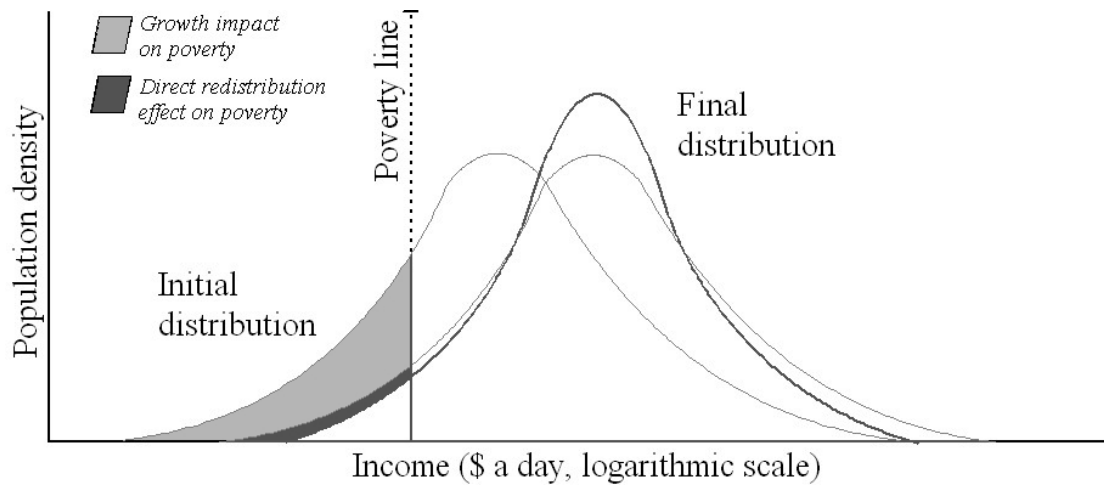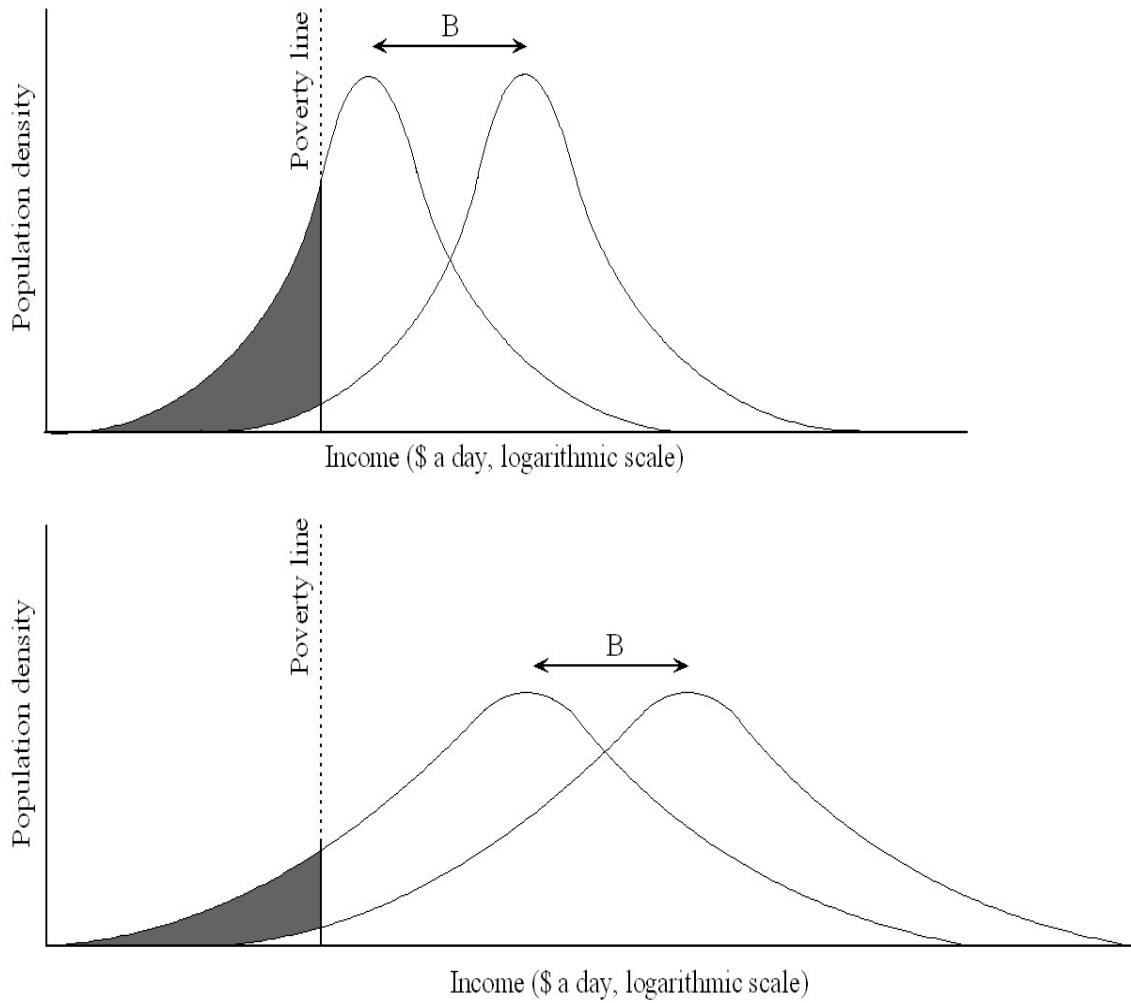Growth and direct redistribution effects on poverty

Figure 2
The role of the initial income distribution in the income-growth effect on poverty

2.2 Income and inequality elasticities of the poverty headcount ratio

Analytically, using Eq. (2) as our definition of poverty, we can derive the income elasticity of poverty as follows:

$$\varepsilon_\mu^H = \frac{\partial H_t}{\partial \mu_t} \frac{\mu_t}{H_t} \equiv -\frac{1}{\sigma_t} \frac{\phi_t\left(\frac{\log(z/\mu_t)}{\sigma_t} + \frac{1}{2}\sigma_t\right)}{\Phi_t\left(\frac{\log(z/\mu_t)}{\sigma_t} + \frac{1}{2}\sigma_t\right)} \leq 0 \tag{5}$$

The income elasticity is always negative. Gini is a known function of σ_t (see Eq. (3)), and positively correlated with σ_t. The elasticity of poverty with respect to inequality, σ_t, is given by:

$$\varepsilon_\sigma^H = \frac{\partial H_t}{\partial \sigma_t} \frac{\sigma_t}{H_t} \equiv \frac{\phi_t\left(\frac{\log(z/\mu_t)}{\sigma_t} + \frac{1}{2}\sigma_t\right)}{\Phi_t\left(\frac{\log(z/\mu_t)}{\sigma_t} + \frac{1}{2}\sigma_t\right)}\left(\frac{-\log(z/\mu_t)}{\sigma_t} + \frac{1}{2}\sigma_t\right) \geq 0 \tag{6}$$

Note that $\varepsilon_G^H = \varepsilon_\sigma^H \frac{\partial \sigma_t}{\partial G_t} \frac{G_t}{\sigma_t}$, with the second term in the r.h.s. (right hand side) always being positive. The inequality elasticity is positive unless a country has very low mean income, i.e., this elasticity is positive only if $\mu_t > z \times \exp\left(-\frac{1}{2}\sigma_t^2\right)$.

The elasticities derived in Eqs (5) and (6) depend on three parameters: the poverty line, mean income and the standard deviation of log-income. Given these three parameters we can calculate the income and inequality elasticity of the poverty headcount ratio.

2.3 Decomposition of poverty trends

The decomposition of poverty trends is based on Eq. (4'). We first disentangle the effect on poverty of a total income-growth effect and of an effect due to a change in Gini:

$$\frac{dH_{rt}}{dt} = \varepsilon_\mu^H\left(z, \mu_{rt}, \sigma_{rt}\right)\left(\frac{d\mu_{rt}}{dt} \frac{H_{rt}}{\mu_{rt}}\right) \tag{7}$$

$$+ \varepsilon_G^H\left(z, \mu_{rt}, \sigma_{rt}\right)\left(\frac{dG_{rt}}{dt} \frac{H_{rt}}{G_{rt}}\right)$$

$$+ \zeta_{rt}$$

where r is a region index. The income and Gini elasticity of poverty for region r in year t are denoted by, respectively, $\varepsilon_\mu^H\left(z, \mu_{rt}, \sigma_{rt}\right)$ and $\varepsilon_G^H\left(z, \mu_{rt}, \sigma_{rt}\right)$. The first term

in the r.h.s. of Eq. (7) is the percentage-point reduction in poverty due to a change in mean income and the second term is the percentage-point reduction in poverty due to a change in Gini. In essence, the decomposition shown in Eq. (7) is identical to that of Datt and Ravallion (1992), bearing in mind that both rely on a parametric specification of the distribution of income.

Next, we decompose the income-growth effect and the effect due to a change in Gini each into three components:

$$\frac{dH_{rt}}{dt} = \varepsilon_\mu^H(z,\mu_0,\sigma_0)\left(\frac{d\mu_{rt}}{dt}\frac{H_{rt}}{\mu_{rt}}\right) \tag{8}$$

$$+ \left(\varepsilon_\mu^H(z,\mu_{r0},\sigma_{r0}) - \varepsilon_\mu^H(z,\mu_0,\sigma_0)\right)\left(\frac{d\mu_{rt}}{dt}\frac{H_{rt}}{\mu_{rt}}\right)$$

$$+ \left(\varepsilon_\mu^H(z,\mu_{rt},\sigma_{rt}) - \varepsilon_{\bar{y}}^H(z,\mu_{r0},\sigma_{r0})\right)\left(\frac{d\mu_{rt}}{dt}\frac{H_{rt}}{\mu_{rt}}\right)$$

$$+ \varepsilon_G^H(z,\mu_0,\sigma_0)\left(\frac{dG_{rt}}{dt}\frac{H_{rt}}{G_{rt}}\right) + \left(\varepsilon_G^H(z,\mu_{r0},\sigma_{r0}) - \varepsilon_G^H(z,\mu_0,\sigma_0)\right)\left(\frac{dG_{rt}}{dt}\frac{H_{rt}}{G_{rt}}\right)$$

$$+ \left(\varepsilon_G^H(z,\mu_{rt},\sigma_{rt}) - \varepsilon_G^H(z,\mu_{r0},\sigma_{r0})\right)\left(\frac{dG_{rt}}{dt}\frac{H_{rt}}{G_{rt}}\right)$$

$$+ \zeta_{rt}$$

The income and Gini elasticity of poverty by region in a base year are denoted by, respectively, $\varepsilon_\mu^H(z,\mu_{r0},\sigma_{r0})$ and $\varepsilon_G^H(z,\mu_{r0},\sigma_{r0})$. In the empirical section, we use 1985 as the base year. The income and Gini elasticity of poverty for all regions in a base year are denoted by, respectively, $\varepsilon_\mu^H(z,\mu_0,\sigma_0)$ and $\varepsilon_G^H(z,\mu_0,\sigma_0)$. The first term in the r.h.s. of Eq. (8) is the effect on poverty of a change in income in region r, using the elasticity in the base year for all regions. In other words, this term is the effect of income growth in region r in the hypothetical case that all regions have the same income elasticity $\varepsilon_\mu^H(z,\mu_0,\sigma_0)$. The second term in the r.h.s. is the effect on poverty of income growth in region r due to the fact that this region's actual income elasticity of poverty in the base year differs from the all-region one. In the case that the income elasticity does not vary across regions, this second term would be equal to zero. The third term in the r.h.s. is the effect on poverty of income growth due to a change over time in the income elasticity of poverty in region r. The fourth term in the r.h.s. is the effect on poverty of a change in Gini in region r, using for each region the Gini elasticity for all regions $\varepsilon_G^H(z,\mu_0,\sigma_0)$. The fifth term in the r.h.s. is the effect on poverty of a change in Gini in region r due to the fact that this region's actual Gini elasticity of poverty in the base year differs from the all-region one. In the case that the Gini elasticity does not vary across regions, this term would be equal to zero. The sixth term in the r.h.s. is the effect on poverty of a change in Gini due to a change over time in the Gini elasticity of poverty in region r.

The last term is a residual capturing the fact this decomposition is based on a first-order approximation (Eq. (4')). This residual term may furthermore capture effects due to deviations in the actual distribution of income from the log-normal distribution.

3   The data

The dataset we use has been developed by Ravallion and Chen, and is known as the World Bank Poverty Monitoring Database (see e.g., Ravallion and Chen 1997, Chen and Ravallion 2001). The dataset is based on nationally representative household surveys, carried out mostly by government statistical agencies, and values of all variables for one country-year are computed from one and the same underlying survey. In this study we use three variables: mean income per month in 1993 PPP and normalized by household size, the Gini index of inequality (based on the same welfare measure) and a poverty headcount measure based on the $2/day poverty line (strictly speaking, $2.16 in 1993 PPPs). Mean 'income' is, in about 60 per cent of cases, based on household expenditures (see Chen and Ravallion 2001, 2004). The poverty headcount measure is equal to the percentage of the population living in households with a per capita income lower than the poverty line. An analysis based on the $1/day poverty line does not change the main conclusions of this study.

Figure 3
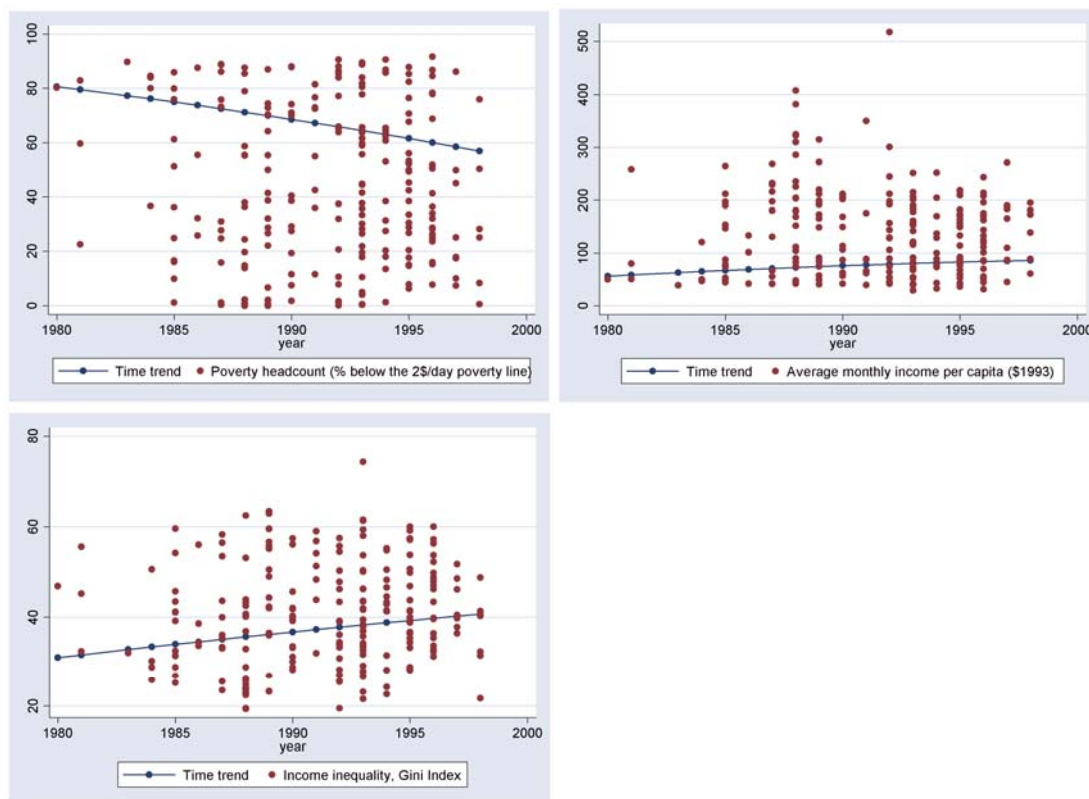Trends in poverty, mean income and inequality, all regions pooled.

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Figure 4
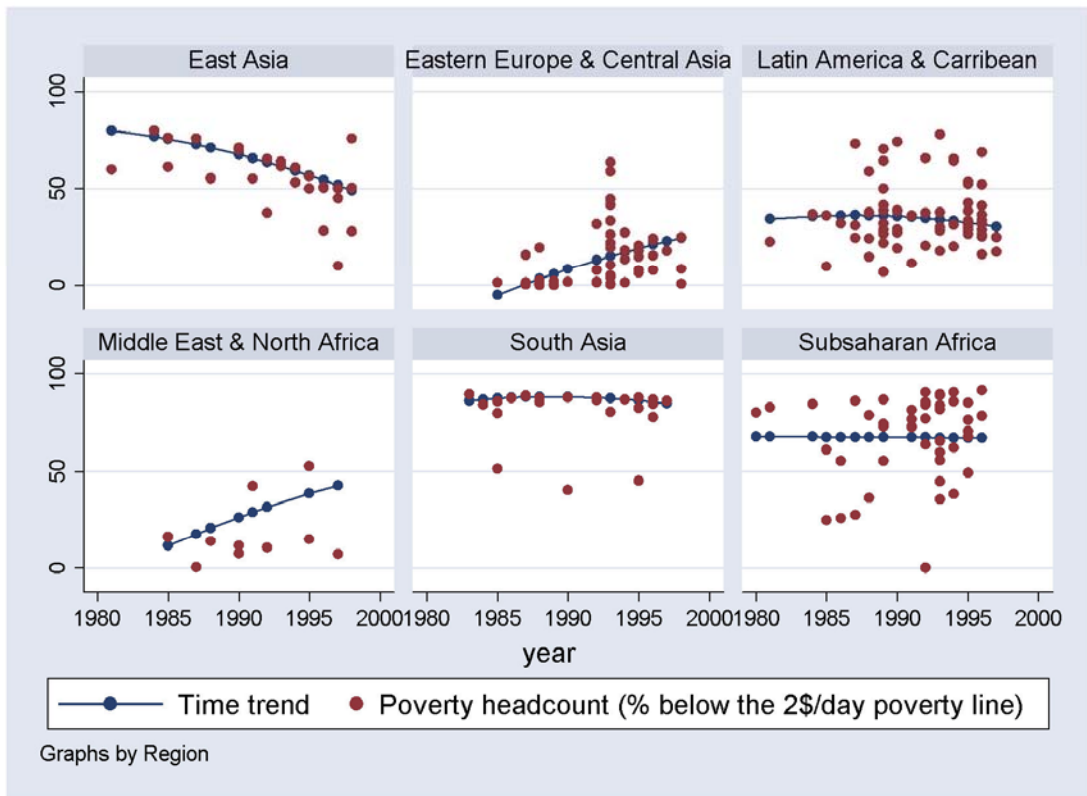Regional trends in poverty, 1980-98

Graphs by Region

Figure 5
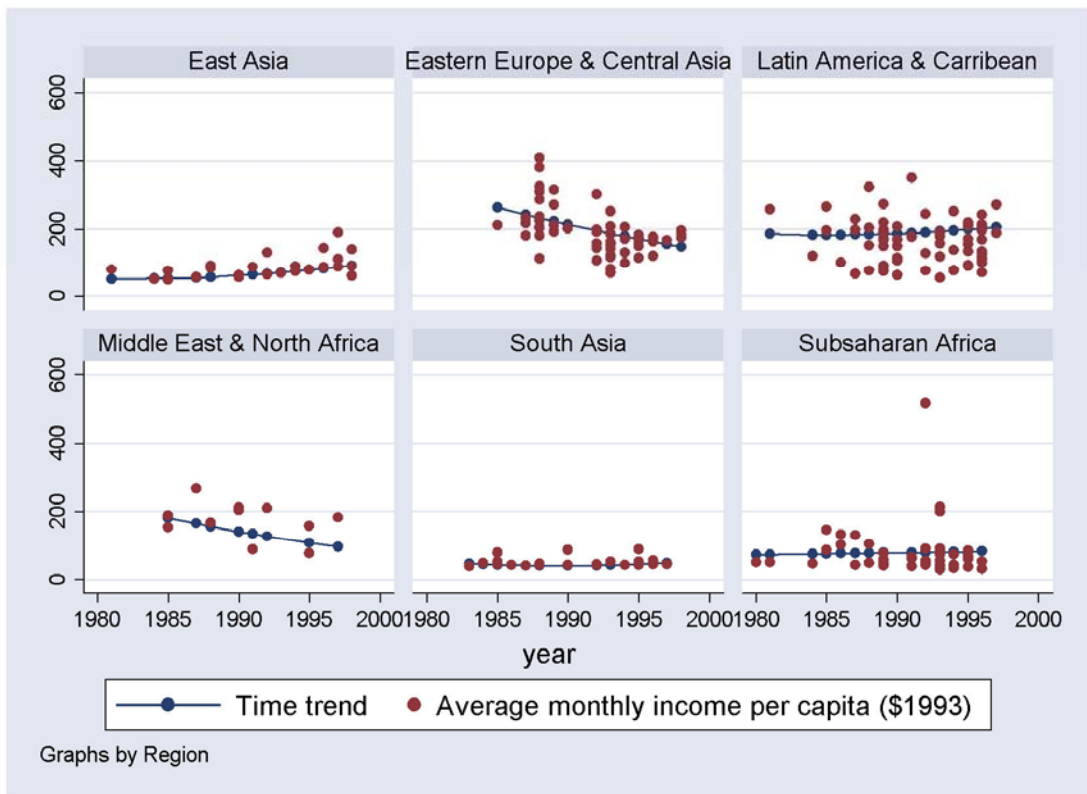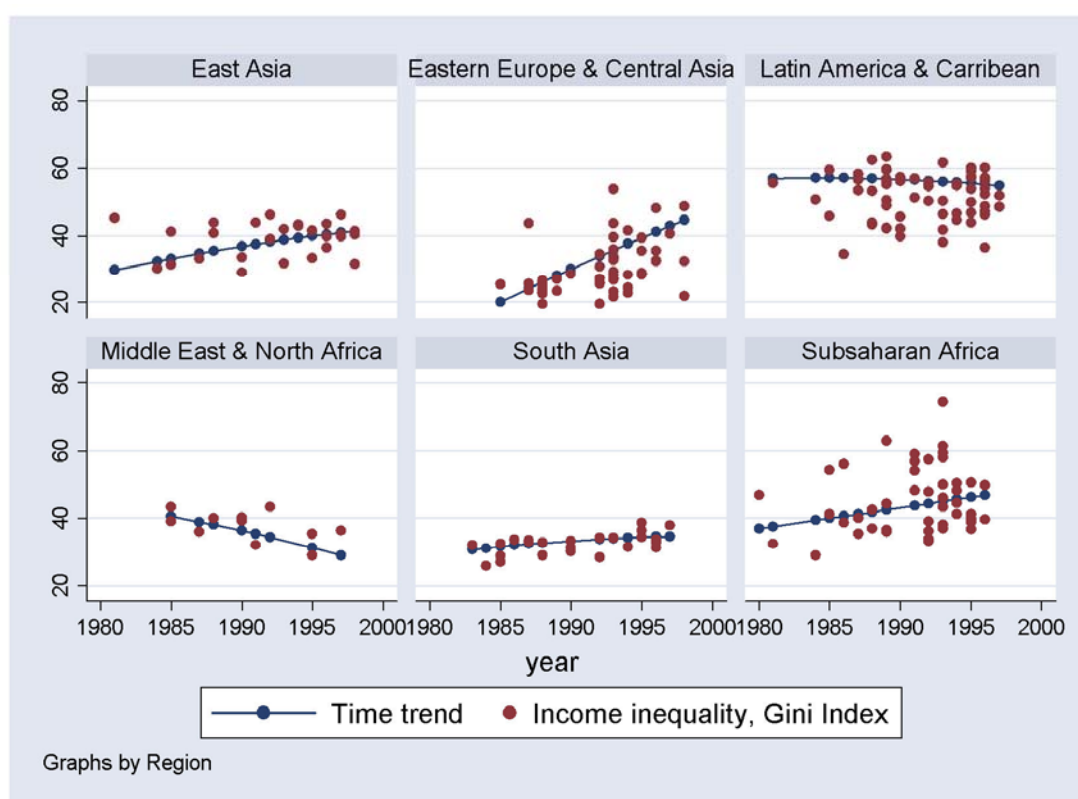Regional trends in mean income, 1980-98

Graphs by Region

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Figure 6
Regional trends in inequality, 1980-98

We have information on the $2/day poverty headcount measure, mean income and the Gini index of income inequality for 76 countries: a total of 227 observations. Six countries in the sample (27 observations) are from East Asia, eighteen (58) from Eastern Europe and Central Asia, another eighteen (62) from Central and Latin America, five (11) from Middle East and North Africa, another five (24) from South Asia, and twenty-four (45) from Sub-Saharan Africa. All data points are plotted in Figure 3. Separate regional plots provide much clearer pictures in Figures 4-6. The time trends are allowed to be nonlinear (see below) but turn out to be virtually linear.

3.1 Predicted regional trends in mean income, inequality and poverty

Ideally one would like to examine poverty trends for each country over many years but there simply are not enough data points; we have on average about three observations per country over the period 1980-98. We therefore restrict our investigation to average trends in the six developing regions, with the further limitation that we have data only for a subset of countries within each region. For this reason we need to determine regional averages per year for each of the variables poverty, mean income and Gini. While one could simply compute average values for each year, a more sophisticated approach, which also allows us to take into account differences in population size relatively easily, is to make regression-based regional predictions for each variable and year. Naturally, in a balanced panel these predictions are weighted averages; in our unbalanced panel this regression-based approach predicts averages also for years for which we have no observations by means of

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interpolation. We do not perform out-of-sample predictions, i.e., no extrapolations. Figures 3-6 show the predicted time trends for 'all regions' and for each region separately. In essence we run for each variable and per region auxiliary regressions in which the variable is regressed on a third-order polynomial in years with each observation weighted with population size. Adding higher order terms makes no difference to the fitted lines in these Figures, referred to as 'time trend'. The general picture that arises from this exercise is that all regional trends are virtually linear; a formal test would not reject linear trends. The estimation results of the trend models with linear time trends are reported on in Appendix A. The (population size weighted) predicted region and time specific values for each variable are used when calculating the income and Gini elasticities of poverty in section 4.

3.2 Descriptive statistics

Figure 3 shows the trends for all regions pooled. These trends are similar to the ones documented in previous studies (Chen and Ravallion 2001, 2004): poverty has decreased by about 25 percentage points from 82 per cent in 1980 to 57 per cent in 1998; over this period mean income has increased by 50 per cent, and income inequality as measured by Gini has risen from 31 in 1980 to 41 in 1998.

Figures 4-6 show the regional trends in poverty, mean income and the Gini index of inequality during the 1980s and 1990s as captured by the weighted averages described above. East Asia experienced considerable income growth and poverty reduction, especially during the 1990s, and a modest rise in inequality. More than one-third of usable observations for this region are for China and because of both the composition of the dataset and, more importantly, because of China's size, East Asia's trends in poverty and income are therefore very much a Chinese story. In Eastern Europe and Central Asia, poverty and inequality rose sharply, whilst the economy contracted severely. The region went from being the lowest-inequality region to being a high-inequality region. Inequality trends are often described as sluggish (e.g., Atkinson and Bourguignon 2000), but this is belied by this region's experience. Latin America saw some growth, some poverty reduction and slightly falling inequality. The Middle East and North Africa experienced economic contraction, rising poverty and falling inequality. It should be remembered, though, that this region is underrepresented in our data. In South Asia mean income and inequality rose somewhat, and poverty fell somewhat. In Sub-Saharan Africa mean income fell somewhat, and both Gini and poverty rose somewhat.

4 Elasticities and decomposition

We first compute in section 4.1 the income and Gini elasticity of poverty by region for several years, based on Eqs (5) and (6) and using as inputs the estimated time trends of mean income and Gini by region and year, as reported in Figures 4-6. Next, in section 4.2, we use these elasticities and the region-specific changes in income and inequality to decompose poverty changes for each of the six regions. This decomposition is based on Eqs (7) and (8).

4.1 Income and Gini elasticities of poverty

We compute the income elasticity using Eq. (5) and the Gini elasticity using Eq. (6), and use these in the decomposition exercise in the next section. Tables 1 and 2 show these elasticities for the selective years 1985, 1990 and 1995.

Table 1 reports the responsiveness of poverty to changes in income, i.e., the income elasticity of poverty. The overall responsiveness remained virtually constant; the income elasticity of poverty is equal to -1.03 in 1985 and -1.06 in 1990 and 1995. The income elasticity of poverty across regions ranges in 1990 from -0.47 for South Asia to -4.21 for Eastern Europe and Central Asia. As can be seen from Eq. (5), this is solely due to variations in income inequality and the ratio poverty line over mean income. *Ceteris paribus*, a higher level of inequality is associated with a lower (absolute value of the) income elasticity of poverty and a higher level of mean income is associated with a higher (absolute value of the) income elasticity (see also Bourguignon 2003 and Epaulard 2003). Our results are not consistent with the findings of Besley and Burgess (2003) that poverty is twice as responsive to economic growth in East Asia as it is in Sub-Saharan Africa; we find the income elasticity of poverty to be of the same order of magnitude in both regions. Although we also find considerable cross-regional variation in the income elasticity, our results may differ from theirs because we explicitly take into account the underlying distribution of income when computing this elasticity, while Besley and Burgess (2003) do not control for differences in the distribution of income. In other words, they estimate what Epaulard (2003) calls the 'apparent' income elasticity of poverty. Table 1 implies considerable intertemporal diversity in poverty's responsiveness to growth for two regions. As mean income increased in East Asia (see Figure 5), the responsiveness of poverty to income changes increased (a higher level of mean income *ceteris paribus* increases the absolute value of the income elasticity of poverty), although this effect has been somewhat tempered by increases in inequality (see Figure 6). Eastern Europe and Central Asia saw their income elasticity fall from an astonishing -10.28 in 1985 (primarily due to its very low levels of inequality at the time) to a much more modest -2.05 in 1995, due both to the spectacular increase in inequality and the severe contraction of the economy apparent in the large fall of mean income.

Table 2 reports the responsiveness of poverty to changes in inequality, i.e., the Gini elasticity of poverty. The overall responsiveness more than doubled from 0.12 in 1985

Table 1
Income elasticities of poverty across regions and time

Region\year	1985	1990	1995
East Asia	-0.61	-0.85	-0.98
Eastern Europe and Central Asia	-10.28	-4.21	-2.04
Central and Latin America	-0.91	-0.98	-1.05
Middle East and North Africa	-1.94	-2.11	-2.10
South Asia	-0.44	-0.47	-0.49
Sub-Saharan Africa	-0.93	-0.85	-0.78
All regions	-1.03	-1.06	-1.06

to 0.29 in 1995. This is mainly the result of the strong increase in the responsiveness in East Asia, which in its turn is a result of a strong increase in mean income. The Gini elasticity of poverty varies considerably across regions, ranging in 1990 from -0.06 in South Asia to 2.94 in Eastern Europe and Central Asia. Noteworthy is that the poverty headcount ratio in South Asia remains almost insensitive to changes in inequality and that the elasticity is even negative due to its very low mean income (see Figure 5). A trend that dominates all others is observed in Eastern Europe and Central Asia where the Gini elasticity of poverty was at its highest (7.54) in 1985, and has been falling to 1.36 in 1995. This strong decrease in the Gini elasticity in this region is due to a strong rise in inequality and fall in mean income (see Figures 5 and 6).

Table 2
Gini elasticities of poverty across regions and time

Region\year	1985	1990	1995
East Asia	-0.04	0.09	0.25
Eastern Europe and Central Asia	7.54	2.94	1.36
Central and Latin America	0.93	1.00	1.08
Middle East and North Africa	1.39	1.14	0.73
South Asia	-0.07	-0.06	-0.05
Sub-Saharan Africa	0.21	0.24	0.27
All regions	0.12	0.21	0.29

4.2 The decomposition of poverty trends

Table 3 presents the results of the decomposition based on Eq. (7). For all the regions except Eastern Europe and Central Asia, the largest effect on poverty is due to changes in income alone. Nevertheless, the size of the effect due to a change in Gini is non-negligible in most regions except East Asia and South Asia. The finding that the effects on poverty through income changes dominate the effects through changes in Gini is a common finding in the decomposition literature cited in the introduction. The relatively small contribution of changes over time in Gini to poverty changes is the combined result of the fact that these changes themselves are relatively small and of relatively low Gini elasticities of poverty. The exception to this general pattern is clearly Eastern Europe and Central Asia, a region which has a large Gini elasticity and has experienced a large increase in Gini, as a result of which the change in Gini is responsible for about one-third of the increase in poverty in this region. The fact that the all-region residual of the decomposition is equal to zero is not by construction but happens to be the case. The fact that most regional residuals are not equal to zero indicates that there may be second-order effects at work; but examining this is beyond the scope of this study.

The last column of Table 3 reports on the predicted poverty reduction when using an income elasticity of poverty equal to -2, as used by Collier and Dollar (2001, 2002) in their policy simulations. As they do implicitly, we set the Gini elasticity of poverty equal to zero. A comparison of their implied predictions for the period 1980-98 in column 3 with our predictions on the one hand and the actual poverty reduction on the

other clearly shows that using their elasticity considerably overestimates rates of poverty reduction over time (by a factor two when we pool all regions), which should caution against expressing euphoric sentiments on the basis of their simulations.

Examining the role in regional poverty trends of regional variation in the income and Gini elasticities is a main objective of this study. In order to investigate this, we perform the decomposition as outlined in section 2, Eq. (8). This decomposition naturally depends on the base year chosen (here 1985), but the main conclusions of our study are independent of the choice of base year. The results of this extended decomposition are reported in Table 4. For 'all regions' the effect of changes in elasticies over time is of minor importance; hence we reach the same conclusion as above: the all-region poverty reduction of about -1.3 percentage points a year is chiefly the result of an increase in mean income, -1.5 percentage points a year, whereas changes in Gini have resulted in a relatively small increase in poverty of about 0.2 percentage points a year. The effects on poverty of changes in the elasticities are small.

For East Asia income growth would have resulted in a poverty decrease of -3.81 percentage points a year, had the all-region income elasticity prevailed in this individual region. However, its relatively low income elasticity yielded a 'loss' in poverty reduction of about 1.23 percentage points a year (0.75+0.48). The effect of its increase in Gini, taken on its own, would have caused a 0.25 percentage-point increase in poverty a year had the all-region Gini elasticity prevailed in this region; however, this effect was somewhat mitigated by a relatively low Gini elasticity, as a result of which no more than 0.06 percentage-point increase in poverty per year is due to increasing inequality.

Eastern Europe and Central Asia experienced a strong increase in poverty over the period 1985-98. Only around 0.5 percentage points are solely due to a decrease in income and 1.5 percentage points a year are due to the relatively high responsiveness to this income change. Over time the income elasticity has strongly decreased (see Table 1), resulting in the smaller increase in poverty of about 1 percentage point a year. These figures show that as inequality rose, the economic contraction of the region became increasingly associated with less extra poverty (per percentage point of contraction, that is). The direct effect of a change in inequality has been small, but the relatively high Gini elasticity caused poverty to increase relatively strongly (1.28 percentage points a year). Most of this increase vanished over time because of the strong decrease in the Gini elasticity.

An increase in income in Central and Latin America is the major reason for the decline in poverty in this region by about 0.4 percentage points a year.

The Middle East and North Africa (or at least those countries for which we have data) experienced a strong increase in poverty. Most of this is due to a decrease in income, but a large proportion of this is due to a high income elasticity, pushing a relatively large number of people into poverty when income declined. Falling income inequality strongly diminished the increase in poverty due to a high income elasticity.

South Asia experienced a tiny decrease in poverty on the back of some income growth associated with a low income elasticity.

Table 3
A decomposition of regional poverty trends in income and inequality effects based on Eq. (7)

| | Period | Observed change in poverty | Change in poverty due to a: | | | Assume, following Collier-Dollar (2002) $\varepsilon_\mu^H(r,t)$ =-2 & $\varepsilon_G^H(r,t)=0$ |
			Change in income	Change in Gini	Residual	
East Asia	1981-98	-1.91	-2.58	0.06	0.60	-7.17
Eastern Europe & Central Asia	1985-98	2.07	0.93	0.74	0.40	0.92
Central & Latin America	1981-97	-0.42	-0.32	-0.11	0.01	-0.67
Middle East & North Africa	1985-97	2.44	2.93	-0.68	0.18	2.82
South Asia	1983-97	-0.15	-0.28	-0.04	0.17	-1.20
Sub-Saharan Africa	1980-96	-0.05	-0.43	0.22	0.17	-0.98
All regions	1980-98	-1.30	-1.46	0.16	0.00	-2.83

Table 4
A decomposition of regional poverty trends in income and inequality effect,
taking into account changes in the income and Gini elasticity of poverty, based on Eq. (8).

			Change in poverty due to a:						
			Change in income			Change in Gini			
				$\varepsilon_\mu^H(r,0)$ -	$\varepsilon_\mu^H(r,t)$ -		$\varepsilon_G^H(r,0)$-	$\varepsilon_G^H(r,t)$-	
	Period	Observed change in poverty	$\varepsilon_\mu^H(0)$	$\varepsilon_\mu^H(0)$	$\varepsilon_\mu^H(r,0)$	$\varepsilon_G^H(0)$	$\varepsilon_G^H(0)$	$\varepsilon_G^H(r,0)$	Residal
East Asia	1981-98	-1.91	-3.81	0.75	0.48	0.25	-0.14	-0.05	0.60
Eastern Europe & Central Asia	1985-98	2.07	0.49	1.45	-1.01	0.10	1.28	-0.64	0.40
Central & Latin America	1981-97	-0.42	-0.35	0.03	0.00	-0.02	-0.09	0.00	0.01
Middle East &North Africa	1985-97	2.44	1.49	1.48	-0.04	-0.15	-0.65	0.12	0.18
South Asia	1983-97	-0.15	-0.64	0.36	0.00	0.14	-0.18	0.00	0.17
Sub-Saharan Africa	1980-96	-0.05	-0.52	0.10	-0.01	0.20	0.03	-0.02	0.17
All regions	1980-98	-1.30	-1.50		0.04	0.21		-0.04	0.00

Notation: $\varepsilon_\mu^H(0) = \varepsilon_\mu^H(z,\mu_0,\sigma_0)$, $\varepsilon_\mu^H(r,0) = \varepsilon_\mu^H(z,\mu_{r0},\sigma_{r0})$. $\varepsilon_\mu^H(r,t) = \varepsilon_\mu^H(z,\mu_{rt},\sigma_{rt})$.

$\varepsilon_G^H(0) = \varepsilon_G^H(z,\mu_0,\sigma_0)$, $\varepsilon_G^H(r,0) = \varepsilon_G^H(z,\mu_{r0},\sigma_{r0})$, $\varepsilon_G^H(r,t) = \varepsilon_G^H(z,\mu_{rt},\sigma_{rt})$.

Base year 0 is 1985.

Sub-Saharan Africa experienced virtually no change in poverty over the period 1980-96, a worrisome observation. Our decomposition shows that income growth yielded some poverty reduction, but the increase in inequality increased poverty. Quantitatively more importantly, this increase in inequality has also led to a decreased responsiveness of poverty to income growth.

5   Conclusions

We examined the role in poverty reduction of changes in income and inequality and, additionally, that of variation in the responsiveness of poverty to these changes, across all major developing regions, over the period 1980-98. We computed the income and inequality elasticity of poverty for each region over time, and decomposed observed regional poverty trends, explicitly quantifying the effects on poverty changes due to cross-regional variation in the income and inequality elasticity of poverty in addition to the effects of variation in changes in income and inequality themselves. We have assumed income to be log-normally distributed in order to be able to calculate the income and Gini elasticity of the poverty headcount ratio, and used a first-order approximation in the decomposition of poverty over time.

The decomposition of observed trends in the $2/day poverty headcount measure during the 1980s and 1990s reveals that:

East Asia saw its poverty headcount fall from 85 per cent in 1981 to 50 per cent in 1998. Most of this was due to income growth alone, but the growth impact on poverty reduction was mitigated by the effect of rising inequality on the responsiveness of poverty to income growth.

Eastern Europe and Central Asia experienced an increase in poverty from 1 per cent in 1987 to 26 per cent in 1998. Rather unfortunately, most of this increase is an indirect effect of its low levels of initial inequality, which, through causing poverty to respond strongly to income changes, meant that the severe contraction it experienced was felt so acutely: a large proportion of the population, before the contraction came, had an income not much higher than the poverty line. Paradoxically, the 'protection' it obtained from rising inequality meant that fewer people were hurt by the contraction of the late 1990s than that of the early 1990s. This effect is of the same order of magnitude as the total effect of the contraction on its own (that is, the effect of the contraction on poverty assuming that the growth elasticity of poverty reduction is a universal constant).

Central and Latin America saw its poverty fall from 39 per cent in 1981 to 32 per cent in 1997. This is mainly an income growth effect.

The **Middle East and North Africa** experienced a poverty increase from 13 per cent in 1985 to 44 per cent in 1997. Most of this was due to the economy's contraction, but its sharply falling inequality (from which it suffered because the economy contracted) diminished this increase in poverty.

In **South Asia** average growth of income per capita has been negligible and the distribution of incomes remained unchanged; hence virtually no changes to its poverty headcount measure of over 80 per cent.

In **Sub-Saharan Africa** poverty remained around 68 per cent, a negligible decrease of only 1 percentage point over the entire period 1980-98. It would have experienced a decrease in poverty due to income growth that would have at least registered, but rising inequality cancelled this out almost exactly.

We carried out this decomposition exercise primarily to illustrate a number of important implications of the recent literature that quantifies the proximate causes of poverty changes, discussed in the introduction. The view that globalization is good for the poor through promoting approximately distribution-neutral income growth needs to be nuanced. Our findings reinforce what has been known since Ravallion (1997) and properly understood since Bourguignon (2003) and Epaulard (2003) that inequality has an important indirect effect on poverty through diminishing prospects for pro-poor growth. It is possible to go even further and identify other features of the income distribution that is in place at the onset of episodes of globalization-induced changes in average income and inequality that affect poverty's response. In a cross-country exercise like ours, with only a handful of parameters known, the location of the mean of the distribution relative to the poverty line is the most obvious candidate. However, when the entire income distribution can be approximated, for example through kernel smoothing techniques, as has been the practice in the most recent within-country decomposition exercises cited in the introduction, the impact on poverty of globalization-induced changes in the location and shape of the income distribution can be quantified more precisely than we have been able to do here. The value of our study should primarily be seen to lie in the fact that we have given an indication of the order of magnitude of the impact of these changes, and of the extent of their variation. It is hard to overstate the importance of the insight that this variation can be predicted *beforehand*, i.e., before a country opens its economy to the blessings or otherwise that globalization will bring it.

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Appendix A

Dependent variable	Poverty H_{rt}		Mean income μ_{rt}		Gini G_{rt}	
Explanatory variable	Parameter estimate	Standard error	Parameter estimate	Standard error	Parameter estimate	Standard error
Constant	167.85	1723.29	-1103.88	3340.63	-1209.12	412.70
Region specific constant (dummy variables)						
East Asia	3933.74	1777.44	-4879.44	3415.38	-23.81	471.44
Eastern Europe & Central Asia	-4603.63	1818.42	18637.39	4671.38	-2496.28	1184.07
Central and Latin America	752.06	1953.05	-2402.81	5438.99	1631.96	541.38
Middle East and North Africa	-5393.28	2948.50	15544.06	6229.16	3154.84	596.41
South Asia	241.79	1724.14	523.59	3342.12	714.81	423.27
Sub-Saharan Africa	0.00		0.00		0.00	
Region specific trend (dummy variable times year of obs)						
East Asia	-2.03	0.22	3.04	0.36	0.64	0.11
Eastern Europe & Central Asia	2.23	0.29	-8.70	1.64	1.88	0.56
Central and Latin America	-0.44	0.46	1.86	2.16	-0.18	0.17
Middle East and North Africa	2.64	1.21	-7.18	2.65	-0.96	0.22
South Asia	-0.16	0.03	0.31	0.05	0.27	0.05
Sub-Saharan Africa	-0.05	0.86	0.59	1.68	0.63	0.21
R-squared	0.91		0.83		0.75	