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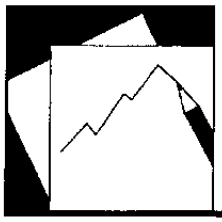

IMF Working Paper

Macroeconomic Performance and Poverty Reduction

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Macroeconomic Performance and Poverty Reduction

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Abstract

This paper investigates the link between macroeconomic performance and the change in the poverty rate among 47 episodes of growth and 52 episodes of economic downturn in developing and transition economies. We show that, on average, (i) the greater the inequality, the lower the elasticity of poverty to growth, and the higher the mean income, the higher the elasticity; (ii) the country-specific elasticity is identical for episodes of economic growth and for episodes of economic downturn; and (iii) higher growth does not bring diminishing returns to poverty reduction. Moreover, we show that very high inflation is associated with a higher elasticity of the poverty rate to economic downturn, but at lower inflation, there is no relationship between inflation and the elasticity of the poverty rate to growth or recession. Trade openness and changes in the terms of trade explain part of the elasticity of the poverty rate to economic downturn.

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I. INTRODUCTION

One of the Millennium Development Goals set by the United Nations is to halve extreme poverty around the world by 2015. What is the economic growth needed to reach this objective? Few are those who would now refute the statement that, on average, growth benefits the poor and that a reduction in poverty is a joint product of economic growth. However, the permanent increase in the number of poor people around the world, mainly in developing countries (see Chen and Ravallion, 2000), and the slow pace of poverty reduction exhibited in countries enjoying durable economic growth raise the question of the efficiency of growth in reducing poverty. The issue is then to identify the characteristics of "pro-poor macroeconomic policies," that is, a set of macroeconomic policies that promotes an economic growth highly efficient at reducing poverty. The aim of this paper is to identify the factors that affect the elasticity of the poverty rate to economic growth.

A. Main Empirical Results Available in the Literature

Identifying the kind of macroeconomic policies that are most efficient at reducing poverty is an ambitious objective that needs to build on both theoretical and empirical research. Even if economic theory helps in understanding the channels among growth, macroeconomic policies, and poverty reduction, ultimately the question of the effects of macroeconomic policies on poverty will be, as often in economics, an empirical one. Yet, the lack of data or their poor quality have until recently discouraged a systematic empirical investigation of the relations among growth, poverty, and macroeconomic policies. An extreme position regarding cross-country work on poverty has been adopted by Srinivasan (2001), who lists possible criticisms of this kind of empirical research and therefore, given the current lack of data and the complexity of the topic, doubts it has any validity. However, given the current demand from developing countries establishing their poverty reduction strategies for empirical results on this topic and the growing availability of data on poverty, a ban on empirical research is not sustainable.

So far, few studies have used a direct measure of the change in the poverty rate to analyze how growth (and economic downturn) translates into changes in the poverty rate. Ravallion (2001) shows that, on average, the elasticity of the $1 a day headcount poverty rate to economic growth is about -2. However, looking beyond the average, one can see that the efficiency of growth in reducing poverty varies a lot from one country to another. Using panel data across Indian states, Datt and Ravallion (2002) show that the elasticity of the $1 a day headcount poverty rate is around -1 and probably less (in absolute value) than that for the 1958–91 period. Ravallion (1997) shows that part of the cross-country variance for the elasticity of poverty with respect to growth is explained by inequality, with high inequality lowering the absolute value of the elasticity poverty rate to economic growth.

A number of interesting empirical papers on "poverty" use the dataset put together by Deininger and Squire (1998). The main result is that the bottom quintile of the income distribution benefits from growth, although there is some uncertainty about the size of the effect. On the one hand,

Dollar and Kraay (2001) report that, on the average, a 1 percent growth in per capita GDP translates into a 1 percent growth in the income of this population; on the other hand, Roemer and Gugerty (1997) find a relationship between the income of the bottom quintile and average income that is less than one-to-one; and Ghura, Leite, and Tsangarides (2002) also show that the one-to-one relationship might not be as robust as the Dollar and Kraay results would suggest. As far as the effects of macroeconomic policies are concerned, most of these studies conclude that there is no direct effect of macroeconomic policies on the GDP share that goes to the bottom quintile. This view is challenged by Ghura, Leite, and Tsangarides, who, when controlling for a large set of policy variables, show that inflation, along with life expectancy and secondary and primary schooling, might have a direct impact on the income of the lowest quintile. Moreover, there is a general finding that neither the degree of openness to trade (measured by the ratio of exports to GDP or the ratio of the sum of exports and imports to GDP) nor trade liberalization has a significant direct impact on the income of the bottom quintile once controlled for overall economic growth.

A major shortcoming of these studies is that poverty rates are not available in the Deininger and Squire's dataset. Hence, these studies on "poverty" approximate the change in poverty for a given country in a given period by the change in the percentage of total income that goes to the bottom 20 percent of the income distribution. Yet the income of the lowest quintile of the income distribution cannot be assimilated to the income of the poor. In some very poor African countries, such as Mali and Rwanda, 90 percent of the population lives below the $2 a day poverty line; whereas in other developing countries, such as the Dominican Republic, less than 20 percent of the population lives below the $2 a day poverty line; and in most transition economies, people whose income are less than $2 a day are less than 10 percent, if not below 5 percent, of the population. Thus, studies using Deininger and Squire's dataset tell us more about growth and inequality than they tell us about the link between growth and poverty reduction. As we will make clear later in this paper, changes in poverty and changes in inequality are not the same thing, since poverty reduction can be contemporaneous with increased inequality.

Finally, a number of empirical papers (Anand, 1991; Anand and Ravallion, 1993; Ranis, Stewart, and Ramirez, 2000; and Moser and Ichida, 2001) independently reach the conclusion that human development indicators (excluding income) are significantly correlated with average income. Moser and Ichida (2001) and Cashin, Mauro, Pattillo, and Sahay (2001) do not find any statistically significant impact of macroeconomic policies on human development indicators other than their impact on economic growth. Looking at sectoral policies, Anand and Ravallion show that the poverty rate and public spending on health do a better job than the mean income at explaining life expectancy at birth. The positive impact of public health care spending on the poorest is also assessed by Gupta, Verhoeven, and Tiongson (2001), even though they doubt that increasing public spending alone in the absence of economic growth will be sufficient to reach the Millennium Development Goals on health.

B. The Methodology

The methodology that we use to address the question of the determinants of the elasticity of poverty to growth is as follows. We first reproduce, as both a starting point and a way of describing the data, the results that other empirical studies obtained on the same kind of data (mainly Ravallion, 2001) when linking poverty reduction to growth. We then compute a country specific proxy for the distributional neutral elasticity of poverty to growth that encompasses the main characteristics of the country income distribution (its mean and its inequality). Econometric estimations on a set of 99 observations (of which 47 are episodes of growth and 52 are episodes of economic downturn in transition and developing economies) show that this approach fits the data better than other approaches currently available in the literature (mainly Ravallion, 1997). Using this proxy, we then address two questions that are relevant for the design of macroeconomic policies. The first question focuses on the asymmetric effect of growth and economic downturn on the poverty rate that may result from the existence of a poverty trap and irreversibilities. If the data were to show that economic downturns increase poverty more than growth reduces it, smoothing out fluctuations would be top on the agenda of any pro-poor macroeconomic policy. The second question relates to a potential trade-off between growth and the efficiency of growth in reducing poverty or, to put it differently, whether slow growth is more efficient at reducing poverty than rapid growth per each percentage of growth. Finally, we check whether socioeconomic indicators and macroeconomic performance (mainly the inflation rate, openness to trade, and the change in the terms of trade) help explain further the elasticity of poverty to growth. One may wonder why we focus on macroeconomic performance rather than on actual macroeconomic policies. We believe that, given the nature of our data, mainly the short period over which changes in the poverty rate are computed, trying to explain changes in the poverty rate using macroeconomic measures like tariffs or their change over time is not a promising approach because it takes time for these policy measures to affect the economy.

There are many ways of measuring poverty. In this paper, we focus on poverty measured by the headcount of poverty for the $2 a day poverty line. One reason for this choice is that it allows us to work with a larger set of countries, since for some transition economies, the percentage of people living below the one dollar a day poverty line was null and remains very low. Another reason is that having the transition economies in the data set is important, since they have some specific characteristics (high average income, low Gini coefficient) that theoretically should influence the link between growth and poverty reduction, and one would like to check whether the theoretical point of view is supported by the data.

The econometric methodology one might follow has to fit the characteristics of the data and the model uncertainty arising from of a lack of theoretical guidance in choosing the set of regressors. The poor quality of the data and the model uncertainty might generate econometric results that are not robust to changes in specification. Oversimplifying, one thus might consider that two empirical strategies can be followed here. The first is the one proposed by Doppelhofer, Miller, and Sala-i-Martin (2000) in the context of their empirical research on sources of economic growth. It consists in expanding as much as possible the set of regressors and then testing systematically for specification robustness by averaging estimators over a

universe of models generated by a set of possible regressors. The main reason for adopting this method is that it limits considerably the scope for arbitrary choices by the econometrician beyond the choice of the initial set of regressors. Applying this methodology, Ghura, Leite, and Tsangarides (2002) challenge the robustness of the Dollar and Kraay's result for which macroeconomic policies do not influence the share of national income that goes to the bottom 20 percent of the income distribution. However, this method makes it difficult to search for non-linear effects that may be of importance and requires a sample larger than that available here. We thus turn to a more traditional econometric approach that carefully looks at the data and provides as many robustness checks as possible. We will systematically check the robustness of our econometric results to changes in the sample that consist in (i) dropping from the sample the most influential observations as identified by a Belsey, Kuh, and Welsch (BKW) test, and (ii) successively dropping from the sample one regional group of observations. Robustness to the set of control variables is also checked.

The paper is organized as follows. Section II describes the data and conducts some preliminary econometric estimations. Section III investigates the link between the elasticity of poverty to growth and the characteristics of the income distribution and the level of development. Section IV proposes some econometric evaluations for the effects of inflation and trade on the elasticity of poverty to growth. Section V summarizes the findings, proposes some concluding comments, and suggests future research.

II. Some Basic Facts on Growth and Poverty Reduction

A. The Data

The data on poverty we use come from a data set put together by the World Bank (see Chen and Ravallion, 1997) that relies on income and consumption surveys and contains the headcount of below $2 a day poverty rate for a set of developing and transition economies. It takes two consecutive surveys with the same methodology to build an observation (the change in the poverty rate). Our sample is thus made of the 99 episodes of growth (of which 47 are episodes of growth and 52 are episodes of economic downturn) in developing, intermediate, and transition economies for which changes in the poverty rate can be calculated. Because the frequency of the surveys varies, not all the episodes have the same length. The mean length is 3.3 years, the minimum length for an episode is one year, and the maximum length of an episode is 13 years. In all the empirical analyses below, all data have been annualized. Along with the various poverty measures, the information about the survey mean income (or consumption) by decile is available, as well as the Gini coefficient. The macroeconomic indicators that complete this data set are taken from the IMF World Economic Outlook. Other sources have been used as well: the social indicators (life expectancy at birth, adult literacy ratio, and primary education enrollment) come from the United Nations indicators, and the data on corruption come from the World Bank (Kaufmann, Kraay, and Zoido-Lobaton, 1999). Details on the data are given in Table 1.

Tables 1 and 2 give the sources and the main statistics for the sample data. The mean $2 a day poverty rate is 41.9 percent and the median is 36.5 percent. However, the standard deviation is quite high (25.4 percent) since the sample includes transition economies where the poverty rate is low (around 10 percent or below), as well as African economies where it is often above 80 percent. The annual mean change in the poverty rate is 4.2 percent (increase in poverty) with a minimum of -26.4 percent (poverty is reduced by one fourth) and a maximum of 73 percent. The median of the change in the poverty rate is close to zero: poverty increased in as many cases as it was reduced. Finally, of the 99 episodes, 47 recorded a positive growth in per capita income (or consumption) and 52 recorded a reduction in per capita income (or consumption).

	Number of Observations	Mean *(in percent)*	Weighted* Mean *(in percent)*	Median *(in percent)*
$d\ ln(c)>0$	47	4.5	3.7	2.7
$d\ ln(c)<0$	52	-8.3	-5.6	-5.2

* Weighted by the number of years in each episode.

Figure 1 is the standard scatter-plot on the annualized growth rate in the survey mean income (or consumption), and the annualized change in the poverty rate measured by the percentage of population living on less than $2 a day: as expected, the more growth, the more reduction in the poverty rate. Another way of looking at the relation between growth and poverty is to look at apparent elasticities computed as the ratio of the relative change in the poverty rate to economic growth. The distribution of these apparent elasticities is shown in Figure 2. Some apparent elasticities are positive (11.2 percent of the observations), meaning that there is a significant number of episodes for which economic growth is associated with an increase in poverty or economic downturns that are in turn associated with a reduction in poverty. Nevertheless, both the sample mean and the median are negative (respectively -1.7 and -1.0). 72 percent of the elasticities lie between -3 and 0, which is a large interval. The remainder of this paper may be viewed as an attempt to explain the heterogeneity in the elasticities of the poverty rate to economic growth.

B. Some Preliminary Econometric Estimations of the Growth/Poverty Relationship

The rough OLS estimation of the linear relationship in Figure 1 reported in Table 3 leads to an elasticity of the poverty rate to economic activity of -1.38. In other words, on average, a 1 percent growth is associated with a 1.38 percent reduction in the poverty rate, which means that, on average, a country with a 1 percent growth rate and with 50 percent of its population below the $2 a day poverty line would see its poverty rate decline by 0.69 percentage points (=1.38x0.50) to 49.31 percent; it would take a 50 percent growth for the poverty rate to be divided by 2 whatever the initial poverty rate. When regional dummies are added in the regression, the adjusted R-square increases from 0.41 to 0.62, meaning that regional dummies are highly significant (see also the F test reported in the last row of the table), and the elasticity drops to -1.07, i.e., halving the poverty rate would now require a 65 percent growth. Even though the estimator for the elasticity is significantly negative in both cases (with and without regional dummies), the point estimation of the elasticity of poverty to growth is not very precise

and can be anywhere between -1.4 and -0.7 (95 percent confidence interval). This partly reflects the large range for the apparent elasticities. These results are close to those of Ravallion (2001). Consistent with the widely accepted hypothesis of a bell shaped income distribution, Ravallion (2001) who uses the $1 a day poverty line, obtains a higher elasticity of poverty to growth (around 2.5).[2]

A macroeconomist may want to know whether the same elasticity is found when the explanatory variable is taken directly from national accounts rather than from surveys.[3] In this case, the sample is then smaller, with only 95 observations, since for some transition economies the change in the per capita consumption is not available. Nevertheless, as shown in Table 3, the estimated elasticity is in the same range when using national accounts data for consumption, although slightly smaller (around 1.11), but the estimation is less precise; standard deviations for the parameters are higher and the adjusted R-square drops.

Econometric results discussed above have been obtained without differentiating between episodes of positive growth and economic downturns. For reasons already discussed in the introduction, one may want to check whether growth is associated with as much reduction of the poverty rate as economic downturns are associated with an increase in the poverty rate. Results reported in Table 3 (column 3) show that, even though the point estimation for the absolute value of the elasticity is higher for economic downturns (-1.11) than for episodes of economic growth (-0.96), the null hypothesis that the two elasticities are equal is far from being rejected (the P value for the Wald test is 0.749). However, when the most influential observations (detected by a standard Belsey-Kuh-Welsch test) are removed from the sample, the elasticity of poverty to positive growth drops to -0.78, whereas the elasticity of poverty to negative growth increases to -1.44, but again, owing to the low precision of the estimates, the hypothesis of the two elasticities being equal cannot be rejected by the Wald test. Performing the same tests using national account data to compute the growth rate of consumption leads to similar results; the estimation of the elasticities is quite sensitive to the sample, and again one cannot reject the hypothesis that the two elasticities are the same.

This rapid overview of empirical findings for poverty-growth relationships raises some questions. First, one would like to explain the heterogeneity of the apparent elasticity of poverty to economic growth by means other than adding regional dummies. In this respect, the three potential sources of the heterogeneity are the income distributional effect, macroeconomic policies, and other structural factors that shape the economy. Second, the potential asymmetric effect of episodes of growth and economic downturns on the change in the poverty rate deserves additional investigation as such asymmetries would matter considerably for the design of pro-poor macroeconomic policies.

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[2]Using the 85 spells for which the change in the $1 a day poverty headcount is available in our data set, we obtain -2.8 as an estimate for the elasticity of poverty to growth.

[3] For a discussion of costs and benefits of using national accounts data, see Ravallion (2003).

III. Level of Development, Income Distribution, and the Elasticity of the Poverty Rate to Growth

If the income distribution were to stay stable during the process of economic growth, knowing the income distribution would be sufficient to predict exactly by how much growth would reduce poverty. This "neutral elasticity of poverty to growth" would depend on the income distribution, and differences in the income distribution would explain the differences in the elasticity of poverty to growth. In cases where the income distribution changes during the process of economic growth, each change in the poverty rate can nevertheless be decomposed into two different effects: the pure effect of economic growth and the effect of the change in the income distribution. Ravallion and Huppi (1991), Datt and Ravallion (1992), and Kakwani (1990) give the basic arithmetic and some empirical evidence of the role of income distribution in the link between growth and poverty reduction.

Our purpose here is to check whether the characteristics of the distribution, along with growth, help explain changes in the poverty rate in our sample. To do so, we compute for each observation, a proxy for the "neutral elasticity of poverty to growth;" we use its product to the observed economic growth as an explanatory variable for the change in the poverty rate and perform some standard statistical tests.

A. Some Basic Arithmetic on Growth, Poverty, and Income Distribution

To compute a proxy for the neutral elasticity we make two additional assumptions : (i) the income distribution can be approximated by a standard log normal distribution, (ii) the parameter of the log normal distribution can be estimated using the per-decile distribution.

Let us start considering a country for which income distribution is log-normal. What would be the effect on poverty of 1 percent economic growth?

The cumulative distribution function ($F(x)$) takes the familiar form:

$$F(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \int_{-\infty}^{\ln x} e^{-\frac{(t-\ln(c)+\sigma^2/2)^2}{2\sigma^2}} dt = \Phi\left(\frac{\ln(x/c)}{\sigma} + \frac{\sigma}{2}\right)$$

where x is income and c is the distribution mean income, σ gives the dispersion of the distribution (the higher it is, the larger the income inequality), and Φ is the cumulative density function for the standard normal distribution (the normal distribution that has a mean of zero and a standard deviation of 1). The headcount poverty rate is simply defined by: $h = F(Pl)$ where Pl is the level of the poverty line. For a given poverty line, the relative change in the poverty rate when consumption (or income) changes without affecting the dispersion parameter is then given by:

$$\frac{dh}{h}=\frac{\Phi\left(\frac{\ln(Pl/c_t)}{\sigma}+\frac{1}{2}\sigma\right)-\Phi\left(\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right)}{\Phi\left(\frac{\ln(Pl/c_{t-s})}{\sigma}\right)}$$

This, when the change in the mean consumption is not too important, can be approximated by:

$$\frac{dh}{h}\approx\frac{\phi\left(\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right)}{\Phi\left(\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right)}\left[-\frac{d\ln(c)}{\sigma}-\left(\frac{\ln(Pl/c_{t-s})}{\sigma^2}-\frac{1}{2}\right)d\sigma\right]$$

where ϕ is the density of the standard normal distribution. This expression can be rewritten using the hazard function for the standard normal distribution (λ):

$$\frac{dh}{h}\approx-\frac{1}{\sigma}\lambda\left(\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right)d\ln(c)+\lambda\left(\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right)\left[-\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right]\frac{d\sigma}{\sigma}$$

Thus, any change in the poverty rate can be decomposed into a growth effect with the elasticity of the poverty rate to the mean income given by: $\varepsilon^N=-\frac{1}{\sigma}\lambda\left(\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right)$, and an inequality effect with an elasticity of the poverty rate to inequality given by: $\varepsilon^I=\lambda\left(\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right)\left[-\frac{\ln(Pl/c_{t-s})}{\sigma}+\frac{1}{2}\sigma\right]$.

The growth elasticity of poverty is always negative. Moreover, one can show that, for a given poverty line, the smaller the inequality (as measured by σ) the more growth reduces poverty, and the higher the mean income, the more growth reduces poverty. This is pictured in Figure 5 where for a given Gini coefficient[4], the higher the mean income, the more negative the elasticity of growth elasticity of poverty, and for a given mean income, the higher the Gini coefficient the less economic growth reduces poverty. For example, with an average income of $150 a month, the growth elasticity of the poverty rate is -3.6 for a Gini coefficient equal to 0.28 (in our sample, 0.28 is the median Gini coefficient for transition economies, see Table 4) and drops to -1 for a Gini coefficient equal to 0.48 (this is still less than the median Gini coefficient for the Latin American countries, 0.54 in my sample, see Table 4). These effects of income distribution and development on the elasticity of poverty to growth are large and should not be neglected when evaluating the relationship between growth and poverty.

[4] Under the log-normal distribution, there is a direct relationship between inequality and the standard deviation of the income distribution which is given by: $Gini=2\Phi\left[\frac{\sigma}{\sqrt{2}}\right]-1$

The elasticity of the poverty rate to income inequality can be either positive or negative: theoretically, in some cases (very poor countries), increasing inequality may reduce poverty. This should not come as a surprise since when mean consumption is well below the poverty line (or more formally when $\ln(c) < \ln(Pl) - \sigma^2/2$), more inequality lifts out of poverty few amongst the large majority of poor. Of course, this result holds only if the income distribution remains log-normal, which is not the case if the increase in inequality comes only from an increase in income of the top of the distribution. When the mean consumption is above the poverty line (when $\ln(c) > \ln(Pl) - \sigma^2/2$), an increase in inequality increases poverty.

Computing the neutral elasticity of poverty to growth requires knowing the two parameters of the income (consumption) distribution, that is c, the mean of the income (consumption) distribution, and σ, the dispersion parameter. The mean consumption c is given in the survey. There are many ways of finding σ; since the actual distribution is not exactly log-normal, each method should lead to a different value for this parameter. We arbitrarily choose to use the two more straightforward ways of computing σ and then average between the two values we get for this parameter. The first method uses the relationship between the Gini coefficient and the dispersion parameter that says that: $\sigma = \sqrt{2}\,\Phi^{-1}\left[\frac{Gini+1}{2}\right]$. The second method uses the relationship among the median, the mean, and the dispersion of the distribution: $\sigma = \sqrt{2\left(\ln(c) - \ln(cm)\right)}$, where *cm* is the median of the distribution (approximated by the median income of the fifth and sixth deciles). So finally, the approximation for σ is:

$$\sigma \approx \frac{\sqrt{2}}{2}\left(\Phi^{-1}\left[\frac{Gini+1}{2}\right] + \sqrt{\ln(c) - \ln(cm)}\right).$$

Figure 4 shows the distribution of the neutral elasticities along with the distribution of the actual ones. Both the sample means and medians are similar. The correlation coefficient of the two series is 0.59. Most of the elasticities lie between two and zero. However, in few cases, the theoretical elasticities are less than five, which means that the efficiency of growth in reducing poverty is quite high. Figure 5 shows the median of the actual and neutral elasticities for the five regional groups of the sample. For African, Asian, and Latin American countries, the medians of actual and neutral elasticities are more or less equal (see also Table 4); for transition economies, however, there is a large difference between the two, with a median of the actual elasticities equal to -4.1 and the median of neutral ones about -5.4. This is actually good news. The fact that the actual elasticity of poverty to growth has been smaller than the one predicted on the basis of their level of development and their level of inequality means that they ended up with less poverty that one could have imagined given the sharp economic downturn they experienced.

From this simple comparison between actual and neutral elasticities, one can conclude that the elasticity of the poverty rate to growth, for a given poverty line, depends on both the level of development (per capita consumption or income) and the income or consumption distribution.

Even if this seems obvious, most of the empirical research looking at the link between growth and poverty does not take this dependence into account. For example, a recent report of the United Nations (2002) argues that, for the $2 a day poverty line, the elasticity of the poverty rate decreases from zero (for very low income countries) to – 2.2 (for countries with a private consumption around $1,500 per capita), without adjusting for the initial income distribution. Another example is given by Collier and Dollar (2001) who evaluate the chance of the millennium goals being reached using the same elasticity of the poverty rate to growth for all the countries without taking into account either their level of development or the shape of their income distribution. Applying a constant elasticity of two to all the countries of their sample, they calculate the changes in the $2 a day poverty rate between 2002 and 2015 that would occur if the per capita GDP growth rate were about the same as the one observed between 1990 and 1996. Their simulation shows that the millennium goal of halving the worldwide poverty rate by 2015 would be met because of the East and South Asia regions. This optimistic result can be challenged solely on the ground that they use a high elasticity of poverty to growth that does not explicitly take into account the level of development and the income distribution. Computations reported in Table 4 show not only that the apparent elasticity of the $2 a day poverty rate (as well as the distributional neutral one) is about -0.9, and is far from being about -2.0, but also that the misleading assumption of a one-elasticity fits all can be easily avoided by using available information on the actual income distribution of each country.

B. An Econometric Experiment

In order to evaluate the gain from using the distribution neutral elasticity in the relation between growth and poverty, we performed the econometric estimation of the following equation:

$$d\ln(h)_{i,t} = b\,\varepsilon^{N}_{i,t-s} d\ln(c)_{i,t} + cte + \tau\left[\frac{\hat{h}_{i,t-s} - h_{i,t-s}}{h_{i,t-s}}\right] d\ln(c)_{i,t} + \text{Regional dummies} + u_{i,t}$$

where $\left[\frac{\hat{h}_{i,t-s} - h_{i,t-s}}{h_{i,t-s}}\right]$ is the relative error of the predicted poverty rate at the beginning of the period using the assumption of a log-normal distribution for which parameters are approximated as explained above.

In explaining the changes in the poverty rate, this equation should perform better than the one using the growth of consumption since the income distribution effect (through the variance of the distribution) as well as the level of development (through the mean of the distribution) are now encompassed in the explanatory variable $\varepsilon^{N}_{i,t-s} d\ln(c)_{i,t}$. The coefficient b is supposed to be positive. Moreover, a coefficient b equal to unity would mean that growth (and economic downturn) benefits (hurts) the income of the poor (or more precisely, the population whose income is around $2 a day) by the same percentage as it benefits the whole economy.

Although the log-normal assumption, along with the approximations of its parameters for each country, leads to an overall good description of the ex ante poverty rate (i.e., the poverty rate at the beginning of the period) with a correlation coefficient between actual and predicted poverty rate of 0.99, the approximation might lead to under- or over-estimates the neutral elasticity of poverty to growth. Adding the relative error in the prediction in the initial poverty rate times the relative growth in the consumption $\left(\left[\frac{\hat{h}_{i,t-s} - h_{i,t-s}}{h_{i,t-s}} \right] d\ln(c)_{i,t-s} \right)$ in the equation permits one to control for this error. A positive relative error in predicting the initial poverty rate leads to underestimating the absolute value of the elasticity of poverty to growth, and one would then expected the coefficient to be negative (if significant).

Econometric performance of this equation is compared with the one obtained using the growth rate as an explanatory variable, or using the growth rate along with the Gini coefficient to control for income inequality as suggested by Ravallion (1997 and 2001). Results in Table 5 indicate that using the neutral elasticity leads to a higher adjusted R-square than the one obtained using the growth rate of consumption or the growth rate of consumption times the Gini coefficient. Moreover, when those two variables are added along with the neutral elasticity, their estimated coefficients are far from being significantly different from zero and their presence in the equation does not modify the estimated parameters for the distribution-neutral elasticity. Finally, the regional dummies are no longer significant when using the distributional neutral elasticity to growth (see the line of p values for regional dummies in the table for the various specifications).

Results in Table 6 show that the coefficient *b* is significantly (at the 1percent level) below unity, even though when the more influential observations are dropped from the sample this is true only at the 5 percent level. However, when allowing different coefficients for episodes of growth and economic downturns, the *b* coefficient is not significantly different from 1 for episodes of growth, but significantly different from (below) 1 for economic downturns. This result is to be compared with the one obtained using positive and negative growth periods without adjusting for the income distribution. In fact, the results were opposite with, on average, a 1 percent economic downturn increasing poverty more than a 1percent economic growth reducing it. So the result here shows that controlling for initial income distribution, the effect on poverty of a 1 percent economic growth and 1 percent economic downturn are of about the same magnitude, and if anything, 1 percent economic growth reduces poverty a little bit more than a 1 percent economic downturn increases it. Table 7 provides an additional robustness check by alternatively dropping from the sample one group of regional observations. The main characteristics of econometric estimations, and even point estimations, are amazingly stable to the change in the composition of the sample.

It may be of interest to relate our result to that of Dollar and Kraay (2001) which shows that, on average, a 1 percent economic growth translates into a 1 percent growth in the mean income of the 20 percent poorest in the economy. The result we obtain here is different. It runs as follows: on average, a 1 percent economic growth translates into a 1 percent growth of the income of

those whose income is close to $2 a day. There are two main differences between these two complementary results. First, we look here at the evolution of the income of the few people living *close* to the $2 a day poverty line while Dollar and Kraay look at the evolution of the mean income of a large part of the population (one fifth). Second, we look here at the evolution of the income of the poor people but not all of them, while Dollar and Kraay look at the evolution of the mean income of a population that includes all the poor but some un-poor as well in some countries, but only the poorest of the poor in other countries. Put together, these two results are complementary and consistent with the general finding that, on average, one cannot identify any link between economic growth and changes in inequality (i.e., changes in the Gini coefficient).

In the sample under review, even though the number of episodes of economic growth (47) is about the same as the number of economic downturns (52), the mean and the median of the amplitude of economic downturns are larger than those of economic growth episodes whatever measure is considered. So yes, if growth is good for the poor, economic downturns are bad for them too; in the data, economic downturns have been much steeper than episodes of economic growth. This is consistent with the conclusion reached by Chen and Ravallion (2000), i.e., in the 1990s, the rise of poverty comes from insufficient growth in poor countries and not from the rise of inequality within countries.

C. Growth and Poverty Reduction: Is There a Trade-Off?

Let us finally consider the question of the existence of a trade-off between growth and poverty reduction. If there is any, the trade-off would be that countries with high growth are achieving less pro-poor growth and might appear less efficient at reducing poverty for each percentage of growth. Yet, because their growth rates are higher, they finally achieved the same poverty reduction than slow growing countries. We propose two different ways of testing for the existence of such a trade-off. The first one consists in computing for each country an efficiency ratio defined as the ratio of the apparent elasticity of poverty to growth to the neutral elasticity $\left(\varepsilon^{A} / \varepsilon^{N}\right)$ and then splitting the sample of countries with a decrease in their poverty rate into two sub-groups: those having an efficiency ratio higher than the median and those having a lower one. Results are shown in the left part of Table 8. The median efficiency rate is 1.29, and the mean annual growth rate for the episodes that have an efficiency ratio higher than that is 4.3 percent (with a median equal to 2.7 percent), while it is only 3.2 percent (with a median equal to 2.4 percent) for those with a smaller efficiency rate. Thus, even if it is difficult to perform a formal statistical test for the poverty / growth trade-off hypothesis, there is no clear evidence that countries that are good at reducing poverty for each percentage growth (after controlling for their initial income distribution) do so at the expense of less growth. If anything, statistics reported in the left part of Table 7 show the opposite. Not only is there no trade-off between growth and poverty reduction, but countries that are the most efficient at reducing poverty per percentage growth, given their initial distribution, exhibit higher growth rates as well.

One concern with the statistics presented in the left part of Table 8 is that the efficiency ratio on which the split of the sample is based may be misleading since the denominator of the ratio (the distribution neutral elasticity) is only a proxy. Therefore, we performed the same test, splitting the sample according to the relative residual $\left(u_{i,t} / d\log(h)_{i,t}\right)$ of the equation reported in Table 6 (column 6) where part of the error on the distribution-neutral elasticity has been eliminated by using the relative error on the initial poverty rate $\left(\text{the term } \left[\frac{\hat{h}_{i,t-s} - h_{i,t-s}}{h_{i,t-s}} \right] d\ln(c)_{i,t-s} \right)$. Statistics for countries that reduce poverty by more than predicted by the econometric estimation are shown in the upper right part of Table 8. The conclusion is the same as the previous one. Countries that, given their initial distribution and level of economic development, perform better than expected at reducing poverty for each point of percentage growth, do not exhibit lower growth rates. Statistics reported in Table 8 show the opposite, i.e., countries that reduce poverty more for each percentage growth also exhibit higher growth. Again, there is no evidence of a trade-off between growth and poverty reduction.

Because we couldn't build a proxy for their neutral elasticity of poverty to growth, neither China nor India are included in the sample under review. During the nineties, these two countries enjoyed high rates of economic growth. Ravallion (2003), finds that these two countries reduced their poverty rate less than one could have expected on the basis of pooled time / country regressions. However, these econometric regressions do not take into account the initial level of development, which, as we showed, help explain the elasticity of poverty to growth. This might be the reason why Ravallion's finding on India and China is in contradiction with our finding that, on average, high rates of economic growth do come along with smaller elasticity of poverty to growth. Yet, back-of-the-envelope calculations, show that, even when roughly controlling for their initial level of development, growth in China and India may well have been less efficient at reducing poverty per percentage point of growth than expected given their income distribution. Further investigation is needed here.

IV. Looking for Pro-Poor Macroeconomic Policies

A. Human Development Indicators, Corruption, and the Elasticity of Poverty to Growth

One would think that high adult literacy and primary enrollment rates would enhance the link between growth and poverty reduction and that a higher life expectancy would translate into a higher efficiency of growth in reducing poverty as well. To test these hypotheses, we simply add among the list of the independent variables an indicator that encompasses this three indicators (*HUM*). And because one might think that whatever the level of this indicator, it is more likely to impact the poverty rate when growth (or recession) happens, we also combine it with the change in per capita consumption ($HUM \times d\ln(c)$). In doing so, we test whether or not the elasticity of poverty to growth is sensitive to human development indicators. One would think that the higher the indicator, the more growth reduces poverty, meaning that the

coefficient of the product of the indicator with the growth rate of consumption is expected to be negative when growth is positive and negative otherwise. Results in Table 9 show that this is not the case. The coefficient is never significantly different from zero, and the econometric results on the link between growth and poverty are barely affected by the inclusion of this indicator. Neither can we show that the less corruption there is, the more efficient growth would be in reducing poverty and the less corruption there is, the less an economic downturn would increase poverty.

B. Is Inflation More Harmful for the Poor?

After two decades of intensive empirical work on the relation between long-run growth and inflation, a consensus emerged among empirical macroeconomists that there is a nonlinear relationship between growth and inflation. Under a certain level, inflation does not affect long-term growth, but for inflation rates above this level, there is a negative relationship between growth and inflation. Economists are now debating the level of the inflation threshold: there is evidence that it is higher for developing and transition economies than for industrial economies (see for example Khan and Senhadji, 2001). As far as poverty is concerned, this nonlinear negative relationship between growth and inflation means that medium and high inflation rates hurt the poor through their negative effects on growth. Nevertheless, there might be an additional channel through which inflation hurts the poor. The traditional argument is twofold. First, the poor are affected by inflation through the decline in their real wages owing to the rigidity of nominal wages. Second, because the poor have limited access to banking services, they cannot insulate their cash savings from inflation and thus suffer relatively more from inflation than the wealthier. This argument is often dismissed on the ground that the cash holdings of the poor are very small; Cardoso (1992) finds this is actually the case in Latin America. However, a study by Lim and Townsend (1994) argues that among Indian households, grain and cash represent the major forms of precautionary saving, and a study by Fafchamps, Pender, and Robinson (1995) on Zimbabwe shows that, in 1994, when the inflation rate was about 25 percent, small investors were receiving a negative real return on their savings while large investors with access to the money market were receiving a positive real return.

Empirical results on the potential remaining effect of inflation on poverty, once controlled for the direct effect of economic growth on poverty, are mixed. Easterly and Fisher (2001) find a positive relationship between inflation and changes in the poverty rate, and Datt and Ravallion (2002), using panel data on poverty amongst Indian states, find that inflation matters to India's poor and attribute this effect to short-term adverse shocks on the real wage of unskilled labor.

To test for the existence of a link between poverty change and inflation, we estimated two alternative models that both allow for a threshold effect. In the first model, the effect of inflation on the change in the poverty rate is additive to the growth effect, which means that a given inflation rate will affect the poverty rate independently of the effect of economic growth or recession. In the second model, there is a joint effect of inflation and growth, and inflation changes the elasticity of the poverty rate to growth.

Model 1:

$$d\log(h)_{i,t} = b\left[\varepsilon_{i,t}\, d\log(c)_{i,t}\right] + \gamma_1\left[\ln(1+\pi_{i,t})\right] + \gamma_2 D_{i,t}^{\pi^*}\left[\left[\ln(1+\pi_{i,t}) - \ln(1+\pi^*)\right]\right] + \beta' X_{i,t} + u_{i,t}$$

$$D_{it}^{\pi^*} = \begin{cases} 1 \text{ if } \pi_{i,t} > \pi^* \\ 0 \text{ otherwhise} \end{cases}$$

Model 2:

$$d\log(h)_{i,t} = b\left[\varepsilon_{i,t}\, d\log(c)_{i,t}\right] + \eta_1\left[\ln(1+\pi_{i,t})\, d\log(c)_{i,t}\right] + \eta_2 D_{i,t}^{\pi^*}\left[\left[\ln(1+\pi_{i,t}) - \ln(1+\pi^*)\right] d\log(c)_{i,t}\right] + \beta' X_{i,t} + u_{i,t}$$

$$D_{it}^{\pi^*} = \begin{cases} 1 \text{ if } \pi_{i,t} > \pi^* \\ 0 \text{ otherwhise} \end{cases}$$

where $\pi_{i,t}$ is inflation based on CPI index, π^* is the threshold level of inflation, $D_{it}^{\pi^*}$ is a dummy variable that takes a value of one for an inflation level greater than π^* and zero otherwise, $X_{i,t}$ is a vector of control variables which includes an intercept, the error on the approximated level of the headcount $2a day poverty rate as explained is the previous section, and in some cases, regional dummies, and the human development and corruption indicators.

In Model 1, the assumptions to be tested are: (i) inflation increases the poverty rate ($\gamma_1 > 0$); and (ii) if, on top of that, there is a threshold effect, a high level of inflation increases the poverty rate even more ($\gamma_2 > 0$).

In Model 2, the assumptions to be tested are: (i) inflation increases the absolute value of the elasticity of the poverty rate to growth when "growth" is negative ($\eta_1 < 0$), but reduces it when growth is positive ($\eta_1 > 0$); and (ii) if there is a threshold effect, a high level of inflation increases further the absolute value of the elasticity to growth when growth is negative ($\eta_2 < 0$) and reduces it further when growth is positive ($\eta_2 > 0$).

In order to compare the econometric results for the two models, both are estimated on the two sub-samples. The first sub-sample contains the 44 negative growth episodes and the second one, the 45 positive growth episodes. Parameters for the two models are estimated with ordinary least squares. Define $S_1(\pi^*)$ as the residual sum of squares with the threshold level of inflation fixed at π^*. The optimal threshold level $\hat{\pi}^*$ is chosen so as to maximize $S_1(\pi^*)$, that

is: $\hat{\pi}^* = \arg\min_{\pi^*} \{S_1(\pi^*), \pi^* = 0, \ldots..1\}$. Once the threshold is found, bootstrap methods can be used to test for the existence of the threshold using a simple methodology proposed by Hansen (1999). This is done using 1,000 bootstrap samples for each econometric estimation. Results are shown in Table 10. The only case in which one would accept a link between inflation and changes in the poverty rate is for Model 2 when growth is negative. In that case, an annual inflation rate above 84 percent (or 82 percent) increases the absolute value of the elasticity of poverty to growth (and the null hypothesis of no threshold effect is rejected at the 5 percent level whatever the set of control variables). When inflation is below that level, inflation does not modify the elasticity of poverty to growth. The point estimation shown in Table 10 (column (3), means than a country with a 100 percent inflation rate would increase the elasticity of the poverty rate to negative growth by 0.18 (e.g., from -1 to -1.18) and a 200 percent inflation rate would increase this elasticity by 1.23 (e.g., from -1 to -2.23). However, the precision of the estimation of both the level of the threshold and the impact (η_2) of inflation above this threshold is low. For positive growth, the econometric estimation of the two models leads to the conclusion that inflation has no impact on the poverty rate other than the one that runs through its negative impact on growth.

C. Openness to Trade, Trade Liberalization, Terms of Trade Shocks, and the Link Between Growth and Poverty Reduction

Winters (2000) proposes a general analytical framework to analyze the impact of trade and trade liberalization on poverty in which he distinguishes the effects that are likely to be channeled to the individuals through the private sector, income distribution, and the government. Clearly the relation between international trade and poverty is complex. Moreover, it may take time before most of the poor directly benefit from it. So far, there is no empirical evidence of the existence of a link between trade and changes in poverty (Dollar and Kraay, 2001; Ravallion, 2001; Bannister and Thugge, 2001), just as there is no clear empirical evidence of the link between trade policy and economic growth (Rodriguez and Rodrik, 2000).

To test for a link between trade and poverty, we add to the list of explanatory variables of the change in the poverty rate two different indicators: the openness to trade *(X+M/GDP)* at the beginning of the period, and the annualized change in the terms of trade over the period. These two indicators cannot be assimilated to trade policy. Openness to trade is not only dependent on the trade policy of a country, but also on its geographical situation and its natural resources. As for the changes in the terms of trade, they are mainly exogenous to trade policy. The empirical strategy is the following. We test for the empirical significance of the two indicators as well as the significance of the product of these two indicators times the annualized growth rate as it is likely that the effect of trade openness and that of change in the terms of trade on the poverty rate are channeled through growth. To check for robustness of the results, we drop the most influential observations as identified by a BKW test, change the list of control variables, and alternatively drop one regional group of countries.

Tables 11 and 12 contain econometric results and various robustness checks. Trade openness does not impact directly the change in the poverty rate, but it reduces the absolute value of the elasticity of poverty to economic downturn. In other words, the more open a country, the less a one point percentage economic downturn will increase its poverty rate. This effect is robust to most of the changes we made either in the set of control variables or in the composition of the sample. How big is this effect? Using a point estimation of 1.2 (see Table 11, column 3), one can compute that, on average, two economies that differ only with respect to their indicators of openness to trade by 0.1, will exhibit elasticities of the poverty rate to economic downturn that differ by only 0.12, with for example, -1 for the more open economy and -1.12 for the other one. Finally, this effect is not symmetric since openness to trade does not seem to have any effect on the elasticity of the poverty rate to positive growth.

As far as the effect of change in the terms of trade on poverty is concerned, the only robust result we got is the following: during a period of economic downturn, for a given decline in the per capita income, the larger the improvement in the terms of trade, the larger the increase in the poverty rate. This effect, which is highly significant, is also robust to most of the changes in the set of control variables and in the composition of the sample. How big is this effect? For a point estimation of -0.05, a 10 percent increase in the terms of trade would decrease the elasticity of the poverty rate to economic downturn by 0.5 (e.g., from -1 to -1.5 or from -3 to -3.5). Another way of putting it is to say that if there is a recession despite an improvement in the terms of trade the effect on the poverty rate is bigger than if the same recession happened without the improvement in the terms of trade.

V. CONCLUSION

In this paper, we build, for a set of developing and transition economies, a proxy for the *neutral elasticity of the poverty rate to growth* that is based on the assumption that the income distribution is log-normal. On average, this proxy is a good predictor (with a one-to-one relationship) of the actual elasticity of the headcount poverty rate to growth. We show that the initial level of development and the initial level of income inequality help predict by how much a one percentage growth will translate into poverty reduction. The higher the inequality, the lower the absolute value of the elasticity; the higher the mean income, the higher the absolute value of the elasticity. This explains why, on average, regions such as Africa and Latin America that differ with respect to both their income distribution and their level of development nevertheless exhibit the same apparent elasticity of the $2 a day poverty rate with respect to growth. For these countries, the average elasticity is around -1, which means that halving the $2 a day poverty rate requires that the low-income country GDP be multiplied by 1.5. Transition economies whose income distribituons are less unequal and that are more developed have a much higher elasticity of the $2 a day poverty rate with respect to growth (around -4), which means that less growth is required to halve poverty. Moreover, our econometric estimations cannot reject the hypothesis that the effect of growth and recession on poverty are symmetric.

We further show that there is no trade-off between growth and poverty reduction, in the sense that countries that exhibit high rates of economic growth are not less efficient at reducing

poverty per each percentage point of growth. Very high levels of inflation (above 80 percent) are associated with a higher elasticity of the poverty rate with respect to economic downturn, but, at lower levels, we did not find any significant relationship between inflation and the elasticity of the poverty rate with respect to growth or recession. Nor did we find any significant relationship between the elasticity of poverty to growth and inflation. Finally, trade openness and changes in the terms of trade explain part of the elasticity of the poverty rate with respect to economic downturn (during recessions, more openness helps reduce the increase in poverty) but do not help explain the elasticity of the poverty rate with respect to growth.

Because the only significant econometric results we obtained in this paper concern the elasticity of poverty with respect to growth, one general finding of the paper is that macroeconomic performance and policies are likely to affect the intensity with which growth reduces poverty but do not affect the poverty rate directly. To put it differently, growth is necessary to reduce poverty, and pro-poor macroeconomic policies are those that enhance the efficiency of growth to reduce poverty. In an ex post evaluation of the impact of macroeconomic policy, the proxy for the *neutral elasticity of the poverty rate to growth* is the natural benchmark to use when evaluating the extent to which growth has been pro-poor.

Table 1. Sample Data

	# obs.	Mean	Std. dev.	Median	Minimum	Maximum
dln(h2) (%)	99	4.2	17.4	-0.16	-26.4	73.4
dln(h1) (%)	85	-0.24	34.5	-0.12	-17.07	108.5
h2 (%)	99	41.9	25.4	36.5	0.43	89.6
h1 (%)	85	19.5	18.3	14.7	0.08	78.4
Gini (%)	99	43.60	10.62	43.41	22.76	63.4
dln(c) from survey (%)	99	-1.89	9.33	0.06	-36.91	16.4
dln(c) from national account(%)	99	5.8	3.91	0.41	-11.25	9.7
ε^A	98	-4.15	28.5	-0.969	-280.0	6.5
Er (%)	99	62.4	16.00	65.00	27.00	86.00
Leb (%)	99	65.0	9.2	68.50	41.00	76.20
Alr (%)	99	79.9	19.7	86.4	36.4	99.9
π (%)	90	66.52	207.9	18.3	1.01	1430.0
Op	90	0.48	0.22	0.45	0.13	1.20
d(Op.)	90	-0.04	0.11	-0.03	-0.34	0.44
dln(TT) (%)	90	1.06	8.22	0.06	-30.9	22.5
Corrupt	96	0.31	0.47	0.30	-1.3	1.3

Table 2. Sample Data: Variable Definitions and Sources

Variable	Source	Definition
dln(h2)	Computed	Annual change in the $2 a day headcount poverty rate
dln(h1)	Computed	Annual change in the $1 a day headcount poverty rate
h2	WB — Ravallion and Chen (1997)	$2 a day headcount poverty rate
h1	WB — Ravallion and Chen (1997)	$1 a day headcount poverty rate
Gini	WB — Ravallion and Chen (1997)	Gini coefficient at the beginning of the period
dln(c) survey	computed from WB — Ravallion and Chen (1997)	c is the average consumption (or income) from the survey
dln(c) national accounts	IMF WEO	C is the per capita consumption
ε^A	computed : dln(h2)/dln(c)	Apparent elasticity of poverty to growth
Er	UN Human Development Indicators	Primary Enrollment Rate
Leb	UN Human Development Indicators	Life Expectancy at Birth
Alr	UN Human Development Indicators	Adult Literacy Rate
π	Computed from IMF WEO	CPI (annual mean over the period)
Op	Computed from IMF WEO	Ratio of Exports + Imports to GDP at the beginning of the period
d(Op)	Computed from IMF WEO	Change in ouv over the period divided by the number of years
Dln(TT)	Computed from IMF WEO	Annual change in the terms of trade
Corrupt	Opposite of WB — Kaufmann, Kraay Zoido-Lobaton (1999)	Index of corruption

Figure 1. Change in the Poverty Rate and Growth

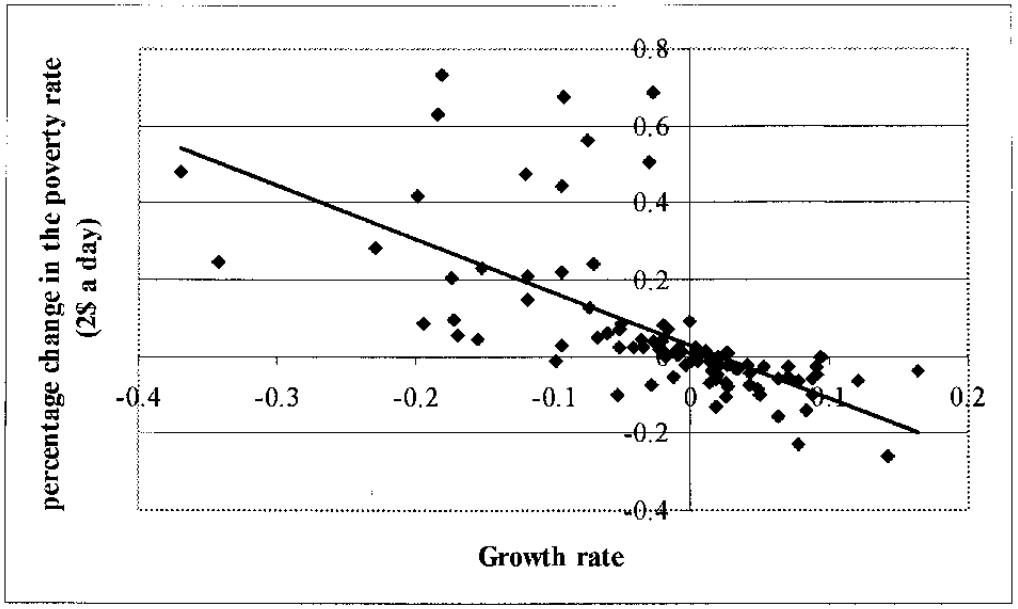
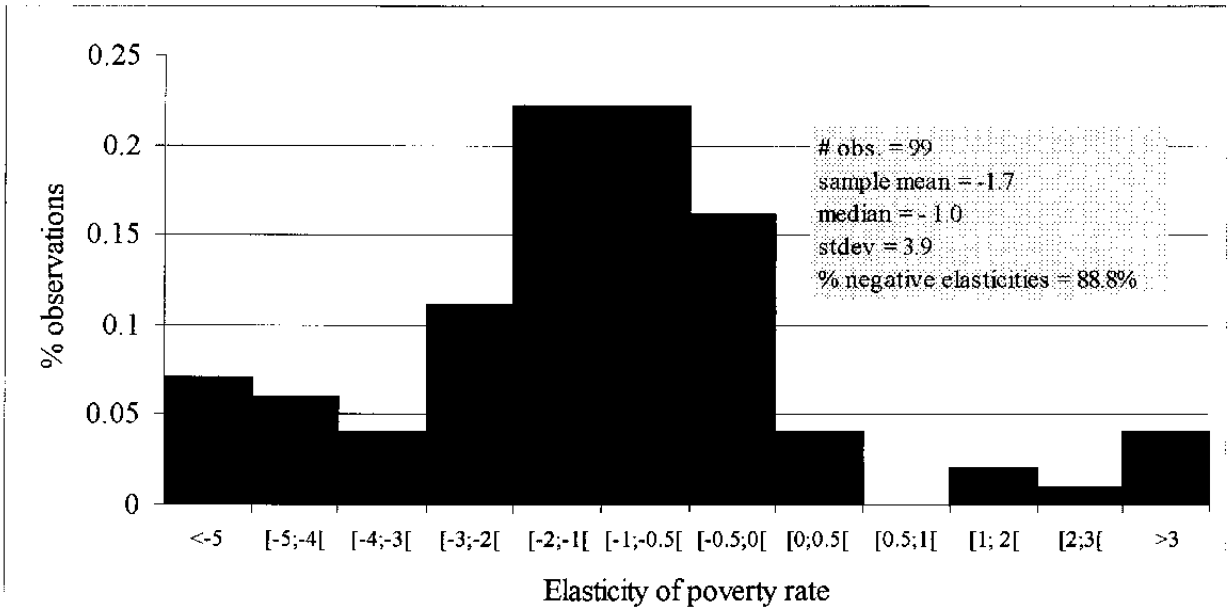


Figure 2. Apparent Elasticities of Poverty Rate[1/] to Growth



1/ Percent of the population whose income is below the $2 a day poverty line

Table 3. Economic Growth and Poverty Reduction

	Per Capita Consumption from Survey				Per Capita Consumption from National Account			
	(1)	(2)	(3)	(4)(a)	(5)	(6)	(7)	(8)(b)
d ln(c)	-1.38***	-1.02***			-1.16 ***	-1.11* **		
	(0.20)	(0.18)			(0.55)	(0.44)		
d ln(c) +			-0.96 ***	-0.78**			-0.31	-1.04***
			(0.30)	(0.32)			(0.55)	(0.44)
D ln(c) -			-1.11 ***	-1.44***			-1.75***	-2.11***
			(0.26)	(0.38)			(0.54)	(0.75)
Reg. dum.	no	yes	yes	Yes	no	yes	yes	yes
F test		13.4	13.3	13.2		12.2	10.76	7.63
Pvalue		[0.000]	[0.000]	[0.000]		[0.000]	[0.000]	[0.000]
Wald test			0.101	1.250			3.30	1.49
Pvalue			[0.749]	[0.262]			[0.069]	[0.220]
Adj. R2	0.424	0.618	0.614	0.610	0.058	0.364	0.382	0.370
# obs.	99	99	99	95	95	95	95	91

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.
d ln(*C*) is the annualized change in the log of the survey mean per capita consumption (or income) or of the per capita GDP when national accounts data have been used. d ln(C)+ is such as d ln(C)+ = max{0, d ln(C)} and d ln(C)+ = min{0, d ln(C)}. The null hypothesis for the F test is that all regional dummies are zero. The null hypothesis of the Wald test is the equality of the coefficients of positive and negative changes in consumption.

(a) Column (4) reports the results of the regression omitting the observations detected as the most influential in regression reported in column (3) by a Belsley, Kuh, and Welsch test.

(b) Column (8) reports the results of the regression omitting the observations detected as the most influential in regression reported in column (7) by a Belsley, Kuh, and Welsch test.

Table 4. Mean of Actual and Neutral Elasticities of the Poverty Rate to Growth

	Monthly Per Capita Consumption ($ PPP 1993,)	Gini Coefficient	ε^N	ε^A
Africa	77	39.1	-0.67	-0.72
Latin American and Caribbean	176	54.5	-1.05	-0.97
Asia	82	36.1	-0.89	-0.80
Middle East	161	35.9	-1.67	-1.56
Transition Economies	191	27.9	-5.35	-4.11

Figure 3. Distribution of Actual and Neutral Elasticities of Poverty Rate to Growth

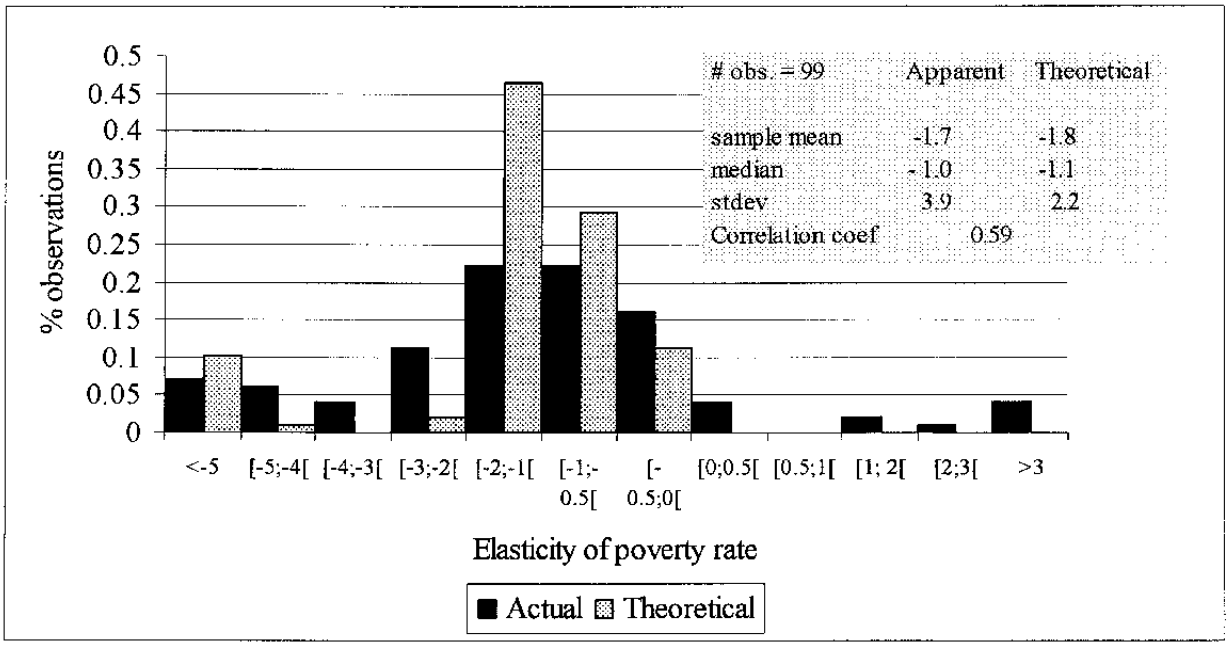


Figure 4. Mean Income, Income Distribution, and the Elasticity of Poverty to Growth

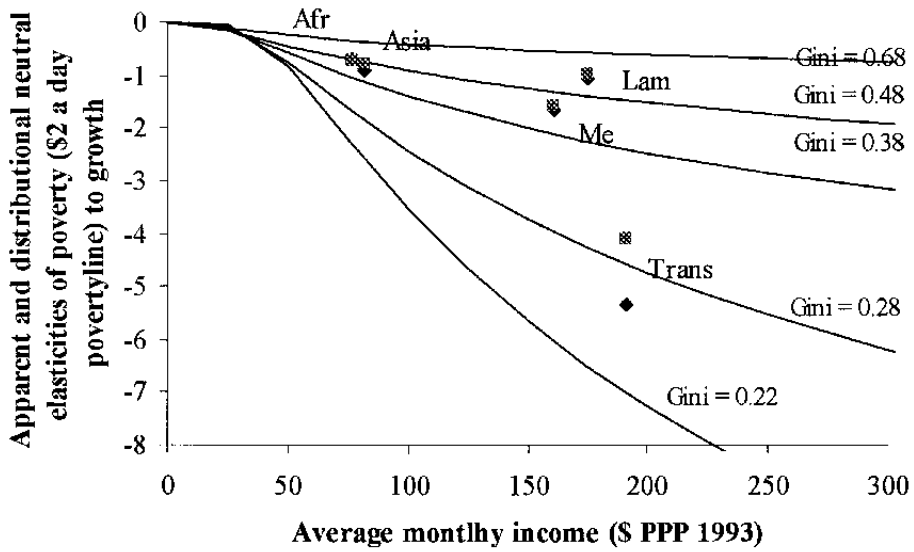


Table 5. Growth, Income Distribution, and Poverty Reduction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
d ln(c)	-1.07***			-2.84***	1.51*	0.11		
	(0.17)			(0.80)	(0.89)	(0.21)		
ε_N d ln(c)		0.651***				0.692***	0.667***	0.712***
		(0.08)				(0.11)	(0.09)	(0.10)
Gini d ln(c)				4.36***			0.11	
				(1.62)			(0.38)	
(1-Gini) d ln(c)			-1.88***		-4.36***			0.27
			(0.32)		(1.67)			(0.43)
Reg. dumm.	yes	yes	yes	yes	yes	yes	yes	yes
P Value for Reg. dumm.	[0.000]	[0.168]	[0.000]	[0.000]	[0.000]	[0.291]	[0.241]	[0.333]
Adj. R^2	0.619	0.758	0.643	0.652	0.648	0.763	0.762	0.763
# obs.	99	99	99	99	99	99	99	99

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.

ε_N is the neutral elasticity of the poverty rate to economic activity, d ln(*C*) is the annualized change in the log of the survey mean per capita consumption (or income), Gini is the Gini coefficient for the survey income (consumption) distribution.

Table 6. Growth, Income Distribution, and Poverty Reduction: Additional Results

	(1)	(2)	(3)(a)	(4)	(5)(b)
ε_N d ln(cs)	0.723***	0.652***	0.744***		
	(0.08)	(0.08)	(0.13)		
P value, Wald test coef -1=0	[0.001]	[0.000]	[0.051]		
ε_N d ln(cs) +				1.07***	0.818**
				(0.29)	(0.39)
P value, Wald test coef -1=0				[0.814]	[0.641]
ε_N d ln(cs) -				0.618***	0.676***
				(0.09)	(0.17)
P value, Wald test coef -1=0				[0.000]	[0.058]
Reg. dum.	no	yes	yes	yes	yes
F test		1.65	2.08	1.81	1.77
Pvalue		[0.169]	[0.089]	[0.134]	[0.142]
Wald test				1.91	0.09
Pvalue				[0.167]	[0.768]
Adj. R^2	0.758	0.764	0.698	0.767	0.672
# obs.	99	99	94	99	93

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.

ε_N is the distributional neutral elasticity of the poverty rate to economic activity, d ln(C) is the annualized change in the log of the survey mean per capita consumption (or income). d ln(C)+ is such as d ln(C)+ = max{0, d ln(C)} and d ln(C)+ = min{0, d ln(C)}. The null hypothesis for the F test is that all regional dummies are zero. The null hypothesis of the Wald test is for the equality of the coefficients of positive and negative changes in consumption.

(a) Column (3) reports the results of the regression omitting the observations detected as the most influential in regression reported in column (2) by a Belsley, Kuh, and Welsch test.

(b) Column (5) reports the results of the regression omitting the observations detected as the most influential in regression reported in column (4) by a Belsley, Kuh, and Welsch test.

Table 7. Growth, Income Distribution, and Poverty Reduction: Robustness Tests

	Without Transition Economics		Without Asian Countries		Without African Countries		Without Middle Eastern Economies		Without Latin American Economies	
ε_N d ln(cs)	0.83***		0.64***		0.65***		0.66***		0.67***	
	(0.14)		(0.08)		(0.09)		(0.08)		(0.09)	
P value, Wald test coef -1=0	[0.230]		[0.000]		[0.000]		[0.000]		[0.000]	
ε_N d ln(cs) +		1.11***		0.99***		0.85***		1.10***		1.51***
		(0.26)		(0.34)		(0.32)		(0.33)		(0.28)
P value, Wald test coef -1=0		[0.673]		[0.997]		[0.644]		[0.755]		[0.061]
ε_N d ln(cs) -		0.77***		0.61***		0.63***		0.62***		0.624***
		(0.17)		(0.09)		(0.11)		(0.09)		(0.10)
P value, Wald test coef -1=0		[0.178]		[0.000]		[0.000]		[0.000]		[0.000]
Reg. dum.	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
F test	0.79		1.49	1.58	1.16	1.18	1.39	1.52	1.76	1.26
Pvalue	[0.532]	[0.489]	[0.214]	[0.189]	[0.336]	[0.327]	[0.242]	[0.204]	[0.331]	[0.295]
Wald test		0.94		1.07		0.37		1.79		7.98
Pvalue		[0.332]		[0.301]		[0.542]		[0.180]		[0.004]
Adj. R2	0.74	0.75	0.76	0. 76	0.76	0.76	0.76	0.77	0.77	0.78
# obs.	84	84	81	81	78	78	91	91	62	62

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.
d ln(*C*) is the annualized change in the log of the survey mean per capita consumption (or income) or of the per capita GDP when national accounts data have been used. d ln(C)+ is such as d ln(C)+ = max{0, d ln(C)} and d ln(C)+ = min{0, d ln(C)}. The null hypothesis for the F test is that all regional dummies are zero. The null hypothesis of the Wald test is the equality of the coefficients of positive and negative changes in consumption.

Table 8. Growth and Poverty Reduction: Is There a Trade-off?

First Test (based on the efficiency ratio)				Second Test (based on relative residuals from econometric estimation)			
		# obs: 24				# obs: 24	
Efficiency ratio > med		Mean	median	$\frac{u_{i,t}}{d\log(h)_{i,t}}$		Mean	median
	d ln(h2)	-8.3	-6.9		d ln(h2)	-9.4	-7.3
	d ln(c)	4.3	2.7	> med	d ln(cs)	4.2	3.5
		# obs: 24		$\frac{u_{i,t}}{d\log(h)_{i,t}}$		# obs: 24	
Efficiency ratio < med		mean	Median			Mean	median
	d ln(h2)	-3.1	-2.5	< med	d ln(h2)	-2.0	-1.7
	d ln(c)	3.2	2.4		d ln(cs)	3.5	2.4

Table 9. Human Development Indicators, Corruption, and the Growth/Poverty-Reduction Relationship

	1	2 (a)	3	4(a)
$\varepsilon_{DN}\, d\ln(cs)^{+}$	1.07***	0.77**	0.97*	-0.27
	(0.29)	*(0.32)*	*(0.59)*	*(0.71)*
$\varepsilon_{DN}\, d\ln(cs)^{-}$	0.62***	0.66***	0.69***	0.83***
	(0.12)	*(0.11)*	*(0.15)*	*(0.31)*
HUM	0.01	-0.93		
	(0.12)	*(0.02)*		
$HUM \times d\ln(cs)+$			-0.43	-1.90*
			(0.28)	*(-0.97)*
$HUM \times d\ln(cs)-$			-0.10	-1.34
			(0.98)	*(1.27)*
Corrup.	-0.01	-0.01		
	(0.01)	*(0.02)*		
$Corrup. \times d\ln(cs)+$			0.35	0.15
			(0.28)	*(0.54)*
$Corrup. \times d\ln(cs)-$			0.61	-0.87
			(0.60)	*(1.17)*
Reg. dumm.	yes	yes	yes	yes
# obs.	96	93	96	87
Adj. R2	0.76	0.72	0.77	0.64

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.

ε_N is the distributional neutral elasticity of the poverty rate to economic activity, d ln(*C*) is the annualized change in the log of the survey mean per capita consumption (or income). d ln(C)+ is such as d ln(C)+ = max{0, d ln(C)} and d ln(C)+ = min{0, d ln(C)}. The null hypothesis for the F test is that all regional dummies are zero. The null hypothesis of the Wald test is for the equality of the coefficients of positive and negative changes in consumption.

(a) Columns (2) and (4) report the results of the regression omitting the observations detected as the most influential in regression reported in column (1) and (3)by a Belsley, Kuh, and Welsch test.
Corrup. is the index of corruption (the lower it is, the less corruption). *HUM* is the mean of 3 different human development indicators: life expectancy at birth, the rate of primary school enrollment, and the rate of adult literacy. For a description of this data, see Tables 1 and 2.

Table 10. Inflation, Growth, and Poverty Reduction

	$d\ln(cs) < 0$						$d\ln(cs) > 0$			
	Model 1		Model 2				Model 1		Model 2	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\varepsilon_{DN}\, d\ln(cs)$	0.54***	0.55***	0.46**	0.59***	0.61***	0.62***	0.92**	0.92**	0.92**	1.14**
	(0.14)	*(0.14)*	*(0.20)*	*(0.19)*	*(0.18)*	*(0.29)*	*(0.36)*	*(0.35)*	*(0.37)*	*(0.52)*
$\ln(1+\pi)$	0.11	-0.05					0.002	-0.13		
	(0.17)	*(0.11)*					*(0.011)*	*(0.14)*		
$D_{\pi>\pi^*}\left[\ln(1+\pi)-\ln(1+\pi^*)\right]$		0.07						0.14		
		(0.13)						(0.15)		
$\ln(1+\pi)\, d\ln(cs)$			-0.43	0.52	0.51	2.09			-0.01	3.51
			(0.60)	*(0.60)*	*(0.60)*	*(1.30)*			*(0.21)*	*(4.1)*
$D_{\pi>\pi^*}\left[\ln(1+\pi)-\ln(1+\pi^*)\right] d\ln(cs)$				-2.15*	-2.12*	-4.30*				-3.62
				(1.24)	*(1.17)*	*(2.30)*				(-0.41)
Adj. R^2	0.59	0.58	0.60	0.64	0.67	0.64	0.40	0.39	0.40	0.39
# of obs.	44	44	44	44	44	44	45	45	45	45
Control variables:										
Regional dummies	*yes*	*yes*	*yes*	*yes*	*no*	*yes*	*yes*	*yes*	*yes*	*yes*
Human development indicators	*no*	*no*	*no*	*no*	*no*	*yes*	*no*	*no*	*no*	*no*
Corruption	*no*	*no*	*no*	*no*	*no*	*yes*	*no*	*no*	*no*	*no*
$\hat{\pi}$ *		0.48		0.84	0.84	0.82		0.12		0.08
# of obs. for which π>π*		13		7	7	7		25		34
p-value (H0 : no-threshold)		[0.670]		[0.039]	[0.032]	[0.025]		[0.872]		[0.348]

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.

ε_N is the distributional neutral elasticity of the poverty rate to economic activity, d ln(*C*) is the annualized change in the log of the survey mean per capita consumption (or income). $\hat{\pi}$ * is the inflation threshold π * for which the sum of square residuals of the regression is minimized. $D_{\pi>\pi^*}$ is a dummy set to one when π>π*, and to zero otherwise.

The p-value for the test of the null hypothesis of no-threshold is obtained with 1,000 bootstrap samples, see Hansen (1999) for a description of the methodology.

Table 11. Trade Openness, Growth, and Poverty Reduction

	(1)	(2)(a)	(3)	(4)(b)	(5)	(6)
$\varepsilon_{DN}\, d\ln(cs)^+$	0.99***	0.63**	1.37**	0.61	1.52**	1.48***
	(0.29)	*(0.29)*	*(0.60)*	*(0.42)*	*(0.50)*	(0.52)
$\varepsilon_{DN}\, d\ln(cs)^-$	0.64***	0.61***	0.96***	1.07***	0.81***	1.03***
	(0.13)	*(0.13)*	*(0.14)*	*(0.24)*	*(0.13)*	*(0.14)*
Trade Openness:						
Op	-0.01	-0.05				
	(0.05)	*(0.05)*				
$Op\, d\ln(cs)+$			0.74	-0.40	1.19	1.00
			(0.57)	*(1.53)*	*(1.85)*	(1.21)
$Op\, d\ln(cs)-$			1.19**	1.66*	2.12*	1.38**
			(0.54)	*(0.96)*	*(0.66)*	(0.56)
Change in the terms of trade:						
(ΔTT)	0.19**	0.16*	-0.27*	-0.31	-0.34*	-0.23*
	(0.10)	*(0.09)*	*(0.15)*	*(0.25)*	*(0.18)*	*(0.14)*
$(\Delta TT)\, d\ln(cs)^-$			0.06	0.06	0.05	0.06
			(0.04)	*(0.07)*	*(0.05)*	*(0.04)*
$(\Delta TT)\, d\ln(cs)^-$			-0.08***	-0.09	-0.08***	-0.08***
			(0.03)	*(0.06)*	*(0.03)*	*(0.02)*
Control variables:						
Regional dummies	*yes*	*yes*	yes	*yes*	*yes*	*no*
Human development ind..	*no*	*no*	*no*	*no*	*yes*	*no*
Corruption	*No*	*no*	*no*	*no*	*yes*	*no*
# obs.	90	88	90	84	87	90
Adj. R^2	0.72	0.70	0.78	0.74	0.77	0.78

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.

ε_{DN} is the distributional neutral elasticity of the poverty rate to economic activity, d ln(*C*) is the annualized change in the log of the survey mean per capita consumption (or income). d ln(C)+ is such as d ln(C)+ = max{0, d ln(C)} and d ln(C)+ = min{0, d ln(C)}. The null hypothesis for the F test is that all regional dummies are zero. The null hypothesis of the Wald test is for the equality of the coefficients of positive and negative changes in consumption.

(a) Columns (2) and (4) report the results of the regression omitting the observations detected as the most influential in regression reported in columns (1) and (3) by a Belsley, Kuh, and Welsch test.

Corruption is the product of the corruption index with d ln(C)+ and d ln(C)- , Human development indicator is the product of variable *HUM* as define in Table 9 with d ln(C)+ and d ln(C)-.

Op is the openness to trade, ΔTT is the annual change in the terms of trade over the period. See Tables 1 and 2 for a description of the data.

Table 12. Trade Openness, Growth, and Poverty Reduction: Robustness Tests

	Excluding Transition Economies		Excluding Asian Economies		Excluding African Economies		Excluding Middle Eastern Economies		Excluding Latin American Economies	
$\varepsilon_{DN}\, d\ln(cs)^{+}$	1.49***	1.43***	1.54**	1.60**	1.13**	0.65	1.71***	1.98**	0.86**	1.11
	(0.37)	*(0.46)*	*(0.59)*	*(0.82)*	*(0.46)*	(0.50)	*(0.63)*	*(0.88)*	*(0.42)*	*(1.04)*
$\varepsilon_{DN}\, d\ln(cs)^{-}$	1.07***	0.91***	1.05***	0.84**	1.13***	0.98**	1.03***	0.82***	1.07***	0.95**
	(0.10)	*(0.21)*	*(0.14)*	*(0.31)*	*(0.20)*	*(0.38)*	*(0.14)*	*(0.31)*	*(0.15)*	*(0.56)*
Trade Openness:										
$Op\, d\ln(cs)+$	1.09	1.94	1.08	1.64	0.88	-0.54	1.24	1.42	-1.83	-2.92*
	(0.87)	*(1.43)*	*(1.39)*	*(0.37)*	*(1.22)*	*(1.78)*	*(1.40)*	*(1.79)*	*(1.29)*	*(2.81)*
$Op\, d\ln(cs)-$	0.84**	1.60**	1.56**	2.31*	1.86	3.48*	1.41**	2.08*	1.53***	1.65
	(0.32)	*(0.61)*	*(0.68)*	*(1.29)*	*(1.26)*	*(2.05)*	*(0.56)*	*(1.24)*	*(0.55)*	*(2.76)*
Change in the terms of trade:										
(ΔTT)	-0.15	-0.17	-0.20	-0.31	-0.29	-0.61*	-0.26*	-0.36*	-0.21	-0.26
	(0.14)	*(0.14)*	*(0.15)*	*(0.21)*	*(0.24)*	*(0.31)*	*(0.14)*	(0.18)	*(0.16)*	*(0.21)*
$(\Delta TT)\, d\ln(cs)^{+}$	-0.02	-0.01	-0.05	0.04	0.08	0.12*	0.07	0.06	0.01	-0.01
	(0.03)	*(0.03)*	*(0.05)*	*(0.06)*	*(0.04)*	*(0.62)*	*(0.05)*	*(0.06)*	*(0.05)*	*(0.06)*
$(\Delta TT)\, d\ln(cs)^{-}$	-0.05**	-0.04**	-0.07***	-0.07***	-0.09*	-0.13**	-0.08***	-0.08***	-0.09***	-0.09***
	(0.02)	*(0.02)*	*(0.03)*	*(0.03)*	*(0.05)*	*(0.06)*	*(0.03)*	*(0.03)*	*(0.03)*	*(0.03)*
Control variables:										
Reg. dummies	*No*	*yes*	*no*	*Yes*	*no*	*yes*	*no*	*Yes*	*no*	*yes*
Corruption	*No*	*yes*	*no*	*Yes*	*no*	*yes*	*no*	*Yes*	*no*	*yes*
Human dev. Indice(?).	*No*	*yes*	*no*	*Yes*	*no*	*yes*	*no*	*Yes*	*no*	*yes*
# obs.	78	75	74	71	69	68	82	80	57	54
Adj. R^2	0.78	0.79	0.77	0.76	0.77	0.77	0.78	0.77	0.83	0.81

Endogenous variable: annualized change in the logarithm of the poverty rate (headcount) for the $2 a day poverty line. Method : ordinary least squares, heteroskedastic-consistent standard errors given in parenthesis.

ε_{DN} is the distributional neutral elasticity of the poverty rate to economic activity, d ln(*C*) is the annualized change in the log of the survey mean per capita consumption (or income). d ln(C)+ is such as d ln(C)+ = max{0, d ln(C)} and d ln(C)+ = min{0, d ln(C)}. The null hypothesis for the F test is that all regional dummies are zero. The null hypothesis of the Wald test is for the equality of the coefficients of positive and negative changes in consumption.

(a) Columns (2), (4), (6), (8) and (10) report the results of the regression omitting the observations detected as the most influential in regression reported in column (1), (3), (5), (7), and (9) by a Belsley, Kuh and Welsch test.

Corruption is the product of the corruption index with d ln(C)+ and d ln(C)- , Human development indicator is the product of variable *HUM* as define in Table 9 with d ln(C)+ and d ln(C)-.

Op is the openness to trade, and ΔTT is the annual change in the terms of trade over the period. See Tables 1 and 2 for a description of the data.

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