

**Draft**

**Comments Welcome**

**Is inequality irrelevant for growth and poverty reduction? \***

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## *Abstract*

This paper examines at both a theoretical and empirical level the relationship between poverty, inequality and growth. Little (theoretical or empirical) support is found for the contention that initial inequality affects the pace of poverty reduction. Empirically, little support is found for the hypothesis that more equal economies grow faster, *ceteris paribus*. On an average basis, the contribution of inequality change to observed poverty reduction is less than 10 percent. This estimate is in striking contrast to the belief that the share may be as high as 50 percent. Finally, the paper examines up to nine measures of “pro-poor” growth – it is shown that simply looking at per capita income growth yields an ordering that is almost identical to that yielded by specialized pro-poor growth indices.

## Introduction

For most of its formative period, the field of development economics was concerned with one overriding, and one related, objective. The former was growth, the latter poverty reduction. Since about the mid-nineties, the focus has shifted to the second, *derived* goal of poverty reduction. While it is recognized that growth is essential, it nevertheless is felt that growth can have differential effects on poverty; in particular, differences can result because of the important mediation on poverty reduction of both the levels, and changes, in inequality. This in turn has re-ignited an interest in an old question – what is the effect of inequality on growth? If neutral and/or positive (i.e. higher equality leads to higher growth) then, as some recent papers have suggested, the possibility exists of a double whammy win-win situation – decrease inequality and not only achieve higher growth, *ceteris paribus*, but also a faster pace of poverty reduction.

This paper explores the inter-linkages between poverty, inequality and growth, at both a theoretical and empirical level. The data used for the study of global inequality and poverty (*Imagine there's no country: poverty, inequality and growth in the era of globalization*, hereafter referred to as *Imagine*) has been extended to the latest year (2003) whenever such data were available. Unlike most prior studies, this paper also examines the trinity of poverty, inequality and growth for the developed countries.<sup>1</sup> This is made possible by the assembling of data on the national poverty lines prevailing in each country. This is another departure from *Imagine* – results are presented not only according to the \$ a day standard, (as well as \$ 2 per capita per day, 1993 PPP prices), but also according to the national poverty line (NPL) adopted by each individual country (ranging from PPP1993\$ 0.63 in Nepal to PPP \$13.6 per capita per day in Switzerland).

A comprehensive evaluation of the poverty-inequality-growth nexus requires that the following three questions be addressed. First, what is the relationship between growth and poverty reduction? This is the all-important policy question – for a given amount of growth, say 10 percent, how much reduction in the head-count ratio of poverty is to be expected? The answer raises an additional second question – what happened to

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<sup>1</sup> This paper is correctly viewed as an extension and elaboration of *Imagine*. “There was now almost a universal concern with the development practitioner’s trinity. The search was on for finding the relationship between poverty, inequality and growth. And for finding policies which would both remove poverty and result in higher growth, and create more equal economies”. (*Imagine*, p. ). The three-way documentation is catchy – Bourguignon refers to it as the poverty-inequality-growth triangle, see Bourguignon(2004).

inequality when growth increased by 10 percent? Third, is there a relationship between the growth that occurred and initial conditions prevailing with regard to inequality? Would growth have been lower if initial inequality was higher? Or lower?

The conclusions ostensibly emerging from now a rather large literature on the subject<sup>2</sup> are the following. First, that growth is an important determinant of poverty reduction, and that the poverty-growth elasticity (one possible indicator of the importance of growth) is in the neighborhood of  $-2$  i.e. each 10 percent of growth in mean per-capita expenditures can be expected to bring down the a decline in the head-count ratio by 20 percent. Second, that in addition to growth, another equally important variable is the change in inequality. Third, that initial conditions are also very important in determining the pace of poverty reduction and that the most important initial condition is that pertaining to equality i.e. the more equal the initial equality in the distribution of income, the faster is the pace of poverty reduction for *the same amount of growth and also assuming that inequality does not change*. Fourth, that in addition to the above determinants, there are other important determinants of poverty reduction e.g. voice, empowerment etc.

These conclusions lead to tangible policies, and policy alternatives. The most important implication leads to a revised look at inequality. In this regard, there is some déjà vu to the earlier initiative, *Redistribution with Growth*, a research-policy agenda launched by the World Bank in the mid-seventies. This revised look suggests that perhaps one should try and achieve greater equality and thereby enter into a win-win scenario – better equality will have two independent effects – higher growth (and *independent of this higher growth*) a faster level of poverty reduction<sup>3</sup>.

It is this presumed relationship between growth-inequality-poverty that is the subject matter of this paper. The voice and empowerment issue is ignored, but only because it acts through either income (growth) or inequality (change). These issues were explored

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<sup>2</sup> Most of this literature has emerged from the World Bank, primarily because of the need for a large number of household data sets. As *Imagine* outlined, it no longer is necessary to have access to unit level household information for derivation of detailed distributions of expenditure (or income); availability of information on just quintile shares is often enough to derive accurate statistics on the distribution, and therefore to derive statistics relating to growth, poverty and inequality. The *Imagine* procedure is an extension of Kakwani (1980).

<sup>3</sup> Such a win-win-win outcome might also be described as the ultimate Viagra policy of poverty reduction.

in some depth in *Imagine*, but several new results are presented here. This paper attempts to offer a consistent, integrated method for examining the (seemingly) intractable trinity, the trilemma. This framework is outlined in Section 2, where the concept of the “shape of the distribution” quasi elasticity (SDE) is introduced (following *Imagine*), and its importance in explaining the poverty-growth relationship highlighted in Section 3. The possible reasons for the omission of SDE in most discussions (to date) about the triangle are discussed in Section 4. Section 5 dwells on the mishaps that can and do occur if the poverty-growth relationship is “conventionally” estimated. This section also examines the conceptual basis for the assertion that initial inequality has a favorable impact on future poverty reduction. Section 6 outlines several methods of measuring pro-poor growth, including an additional method based on a standardized poverty decline (i.e. poverty decline adjusted for different SDEs). Section 7 presents the new evidence on the trilemma and relates the results to the burgeoning pro-poor literature. The section contains empirical results on various trilemma issues – initial inequality and future growth (no relationship), differing elasticities with respect to poverty decline for growth and inequality (not the case), the dependence of poverty decline on initial inequality (not the case), magnitude of the elasticity reveals the nature of pro-poor growth (not the case at all).

Four results of this paper deserve special emphasis. First, that, contrary to conventional wisdom, theory does not suggest any relationship between initial inequality and future poverty reduction. Second, that inequality change and average income growth have the *same* elasticity with respect to poverty reduction. In other words, attempts at estimating separate growth and inequality elasticities have been misplaced (e.g. by Datt-Ravallion(1993,2002), Kakwani(1993) etc.) Third, that the conventionally measured growth-poverty elasticity maybe empirically flawed, and fourth that in the aggregate, initial inequality accounts for very little – between 10 and 20 percent – of poverty change, the remainder being well explained by economic growth. **Inequality does not appear to be at all an important consideration in the analysis of poverty reduction.** Simply put, chasing the potent benefits of equality has been a mirage – just like the earlier *Redistribution with Growth* exercise twenty years earlier.

## **Section 2: An integrated framework for examining poverty, inequality and growth**

A consistent framework requires that the definitions of the three important variables be explicit, and clear. There are several definitions of *Poverty*, but the one used here is the head-count ratio i.e. the fraction of the population whose per-capita expenditures (or income) are less than, or equal to, a pre-defined level of expenditures given by a “poverty line”. *Inequality* can be measured by several indices (share of expenditures of the bottom 20 percent, the ratio of mean expenditures of the bottom 20 relative to the top 20 percent, the Gini index, the Theil index etc). All these are aggregate indices – the point of departure of our analysis is that what is relevant for poverty reduction is not the decline in *aggregate* inequality but rather the change in inequality *at (or close to) the poverty line*. That this is neither trivial, nor just a theoretical point, is testified by the empirical results presented. *Growth* is the least problematic, definitionally, but even with this variable there are problems, and controversy. In particular, as argued in Bhalla(1997b), *Imagine* etc., there is a need to be consistent about deriving *growth estimates from the same source as the poverty estimates*. For example, given an estimate of the distribution of expenditures, poverty calculations using *growth* rates as revealed by national accounts will be different than the poverty estimates which use household survey growth rates. There is no comment here on which is the correct procedure – only that when exploring the growth-poverty relationship, one has to be sure that both are obtained from the same source.<sup>4</sup>

If growth and poverty are consistently defined, then a straightforward identity relationship exists between the two i.e.

$$(1) \quad H_t = F(Y_t)$$

Where  $H$  is the head-count ratio at time  $t$  and  $F(Y_t)$  the cumulative distribution of per-capita expenditures. To every level of cumulative expenditure  $Y$ , there corresponds a unique level of the head-count ratio. Thus,  $H$  goes from 1 to 0 as  $Y$  goes from 0 to  $\infty$ . (For a given value of  $Y$ , say the poverty line  $P$ , the head-count ratio is read as  $F(P)$ ).

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<sup>4</sup> This has been a common error. Among others, both the World Bank’s poverty expert, Martin Ravallion, and Nobel laureate, Mr. Joe Stiglitz, have been guilty. [Insert quotes]. In *Imagine*, this confusion was termed the Peter-Paul error i.e. linking growth rate from national accounts, to decline in survey data poverty was akin to attributing Peter’s income to Paul’s poverty.

This identity makes clear that *monetary* poverty (i.e. poverty in money incomes and not poverty due to lack of education etc.) is explained by knowledge of the level, and distribution of expenditures. Note that there is no simultaneous relationship between the level of income and poverty, nor is poverty a function of either time or other exogenous variables, after controlling for mean incomes and the distribution of such incomes.<sup>5</sup>

Differentiating equation (1) and noting that the derivative of the cumulative distribution  $F(Y)$  is the density  $f(Y)$ , one obtains<sup>6</sup>

$$(2) \quad dH = f(Y)dY$$

Multiplying both the numerator and the denominator on the right hand side of the equation by  $Y$  (*one* value of which is the poverty line, and another value is the mean), one obtains

$$(2') \quad dH = Y*f(Y)dY/Y = Y*f(Y)*Y'$$

where prime indicates growth. If this equation is evaluated at a value of  $Y$  equal to the poverty line  $P$ , then equation (2') can be written as

$$(3) \quad dH = P*f(P)*P'$$

where  $P'$  indicates the income growth at the poverty line, and  $f(P)$  the density at the poverty line.

**Equation 3 is arguably *the* equation of interest to policy makers i.e. it answers the question of the change in poverty, in percentage points, for a given amount of growth,  $Y'$ .** The left hand side of equation (3) is not the *percent change* in the head-count ratio,  $H'$ , but rather  $dH$  or change in *percentage points*.

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<sup>5</sup> See Srinivasan(2003) who argues that such is the case.

<sup>6</sup> See *Imagine*, section entitled, pro-poor math, pages 151-58, for a discussion of the formulae presented here

It is important to note, and this becomes critical in the empirical application later, that the left hand side of equation (3) has not growth (percentage change) in poverty but rather just the change in percentage points. In contrast, conventional poverty-growth models have percentage change on both sides of the equation (see below).

Note also that the term on the right hand side of the equation is a product of two terms, the poverty line,  $P$ , and the density evaluated at the poverty line,  $f(P)$ . Since this density refers to the condition existing *prior* to economic change, the RHS of the equation should properly be written as

$$(4) \quad dH = \{P*[f(P)]_{t-1}\} * Y'$$

What this means is that the coefficient of  $Y'$  is known *ex-ante*. But 3' has not been the equation estimated by most analysts; (one exception is *Imagine*). The equation estimated is with percent change in the HCR as the dependent variable. Division of both sides of equation 2' by initial head-count ratio ( $H_{t-1}$ ) or  $H_0$  does yield the “standard” growth-poverty elasticity.

$$(5) \quad dH/H_0 = Y*f(Y)*Y'/H_0$$

$$(6) \quad \zeta = [H'/Y'] = Y*f(Y)/H_0$$

The elasticity evaluated at the poverty line,  $P$ , is therefore given by

$$(6') \quad [H'/Y'_P] = P*f(Y_P)/H_0$$

where  $Y_P$  represents the mean incomes of the individuals near the poverty line. In turn, the growth in incomes at the poverty line,  $Y'_P$ , can be written as the sum of the growth in aggregate mean incomes,  $Y'$ , and the growth in the *share* of incomes of the fraction  $X$  close to the poverty line,  $Y'_X$  i.e.

$$(7) \quad Y'_P = Y'_M + Y'_X$$

Substituting for  $Y_P'$

$$(8) \quad H' = \{P^*f(Y_P)/H_0\}^* (Y'_M + Y'_X)$$

Dividing both sides of equation (8) by the mean growth in average expenditures,  $Y'$ , one again obtains the expression for the growth-poverty elasticity,

$$(9) \quad [H'/Y'_M] = \zeta = \{P^*f(Y_P)/H_0\}^* (1 + (Y'_X/Y'_M))$$

Thus the conventional elasticity,  $\zeta$ , is a function of the poverty line, *and* the initial poverty level. With the latter it is unambiguously negatively related, suggesting that it be problematical if inferences about the nature of growth were made from knowledge about the magnitude of this elasticity.

Equation (9) integrates the trinity – poverty decline, inequality change and average income growth. If it is assumed that inequality change  $Y'_X$  is zero, then this equation *reduces* to the conventionally measured elasticity as a special case.

$$(10) \quad [H'/Y'_M] = P^*f(P)/H_0$$

The central role in the above equations is that of the product  $P^*f(P)$  and its property that for any period of forecast (or change) it is known before-hand. In *Imagine*, the product  $P^*f(P)$  was termed the “**shape of the distribution**” elasticity or SDE – *this quasi-elasticity yields the total change in poverty that can be expected with a unit change in mean expenditures of individuals clustered around the poverty line.*

Rewriting equation(10), and realizing that income distribution is staying constant, the equation can be rewritten as

$$(10') \quad H' = \{SDE/H_0\}^* Y'_M$$

The implication of both equation (3) and (10) is radical. It means that the poverty elasticity for any growth process is known before-hand. Does that mean that different

patterns of growth do not affect poverty differentially? No. Because in equation 10' inequality change has been assumed constant – so, by definition, the only change in incomes that occurs is through growth and it has a pre-determined effect given by the ratio (SDE/Ho).

This, in turn, has a strong implication – one cannot, as has been done by several authors (see Datt-Ravallion(2002)) use the estimate of the elasticity as an estimate of the goodness (or pro-poor nature) of growth. The elasticity will vary with the poverty line chosen, the density at the poverty line, and the poverty level in the previous period!

What happens in the more general case when inequality is allowed to change; in this instance, it is equation (9) which is of interest. Assume for a moment that growth was primarily concentrated in the poor regions of the country and only the poor benefited e.g. the growth in incomes of the poor ( $Y'_P$ ) was say 10 percent and mean growth,  $Y'$ , was 3 percent. By construction, there has been a positive inequality change in that the share in incomes of the poor,  $Y'_X$ , has gone up by 7 percent (from equation 7). What is the predicted impact of this income growth on poverty – exactly equal to the ex-ante value of (SDE/Ho)! In other words, the elasticity has remained the same, regardless of whether inequality improved or worsened.

It is easier to see the impact of SDE in the equation for dH: (rewriting equation 4):

$$(4') \quad dH = P * f(Y_P) * Y'_M \text{ or}$$

$$dH = SDE * Y'_M = SDE * Y'_P = SDE * (Y'_M + Y'_X)$$

It maybe a difficult matter to estimate  $Y'_P$ , but equation (4') is exact at the poverty line P, and quite exact for reasonably large changes in consumption  $Y'_P$ . For non-small changes in expenditure, equation (4) does not hold exactly, for the simple reason that these changes in expenditures most likely traverse a large portion of the density function and the arc elasticity estimated by SDE is an average of several “arcs”. However, the approximation for even large changes is very close (see *Imagine*).

The above demonstrated importance of SDE for both within and cross-country analysis has been either not appreciated, or misunderstood, by Ravallion and Zettelmeyer in their

respective “reviews” of *Imagine*. Both authors believe that adjustment by SDE is either superfluous or irrelevant!

“However, Bhalla has done nothing more than re-scale the regressor, multiplying the growth rate by a number (specific to each data point) that is typically less than unity”. (Ravallion 2002, p. ]

“The first exercise involves regressing changes in the poverty head-count ratio on income growth multiplied by a factor, which he calls the “shape of the distribution elasticity,” that captures the density of the income distribution at the poverty line. Bhalla estimates a regression coefficient of about unity. But this regression is almost meaningless because the true regression coefficient is unity by construction”. (Zettelmeyer, 2003, p. )

It is true that the coefficient for  $Y_p'$  is unity by construction (in equation 4), and under the assumption that inequality does not change, the coefficient of income growth is also unity. But empirical economics is sometimes facts in search of a theory; other times it is facts as verification of theory. In neither instance can the pursuit of facts be described as “meaningless”. Ravallion’s criticism is also not understandable – the regressor is being rescaled differently for different circumstances – this is the method for incorporating initial conditions, something that research and policy analysis should control for.

### **Section 3: *The growth-poverty elasticity***

The growth poverty elasticity,  $\zeta$ , has been one of the most studied in the literature on poverty and pro-poor growth. Some have used it as an index of pro-poor growth (e.g. Datt-Ravallion], while others have assumed a constant value for it for forecasting purposes (Collier-Dollar). For over a decade (since World Bank(1990)), it has been assumed that *initial inequality* has a negative effect on poverty reduction. In two recent papers, Bourguignon(2003,2004) assumes an underlying log-normal distribution of expenditures to make  $\zeta$  tractable<sup>7</sup> and to uncover its dependencies.

#### ***Implications about the growth-poverty elasticity***

##### *Implication 1: $\zeta$ ambiguously depends on the magnitude of the poverty line*

The elasticity depends on the level of the poverty line used. The partial derivative of the elasticity with respect to poverty line  $P$  is given by the sum  $(f(P) + Pf''(P))$  where  $f'(P)$  is the marginal *change* in the density at the poverty line. The first term is always positive but  $f'(P)$  can be both positive and negative. It depends; thus the impact of the poverty line on the growth poverty elasticity is ambiguous.

##### *Implication 2: $\zeta$ negatively depends on the magnitude of initial poverty*

Even if an empirical estimate for  $\zeta_H$  is available (either directly, via  $f(Y)$  as done in *Imagine* and in this paper, or indirectly and as an approximation by Bourguignon who assumes a special functional form for  $f(Y)$ ), it should *not* be used for inferring much about the pattern of growth. The elasticity  $\zeta_H$  depends on the value of the initial head count ratio,  $H_0$ . In other words, with development, there is an increase in per-capita incomes, a decline in the poverty ratio,  $H_0$ , and a corresponding increase in the poverty elasticity. Indeed, this elasticity can approach infinity as one approaches lower and lower levels of poverty.

Thus, the lower the initial level of poverty,  $H_0$ , the higher the elasticity,  $\zeta$ ! This result is disturbing for those who have argued that the pro-poor nature of growth is indicated by the growth-poverty elasticity. Assume for a moment that a country reduces its poverty to single-digit levels. This is considered the area of hard-core poverty i.e. growth is

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<sup>7</sup> Note the involvement of the highly non-linear term, the density,  $f(Y)$ , in the equation for  $\zeta$ ; if an estimate for the density function at the poverty line is computed (as done by Kakwani in 1993, Deaton-Tarozzi in 2000 and *Imagine*), then the simplifying assumption of a log-normal distribution is unnecessary and can be potentially misleading.

presumed to have less and less effect on poverty reduction at such low levels. Non-growth policies are deemed necessary since several such individuals might be old (so pensions are desirable), or invalid or out of the “system”. Yet the conventional method, use of  $\zeta$ , suggests that it is now “easier” to reduce such poverty because the elasticity is high. As emphasized in *Imagine*, the traditional approach yields several misleading results – this result, of elasticity being high at low levels of the head-count ratio, is just one illustration.

*Implication 3:  $\zeta$  does not depend on aggregate inequality.*

There is no expression for *aggregate* inequality in equation 9. This is an important conclusion since the literature is replete with discussion about how initial inequality has a strong role to play in poverty reduction. Note that the density at the poverty line,  $f(P)$ , does affect  $\zeta$  but there is no guarantee that there is a monotonic, or even a positive, relationship between inequality at the poverty line and aggregate inequality (see below for a more detailed discussion).

While appropriate for the average person, aggregate inequality calculations are *inappropriate* for the *poor* population. A simple example will help illustrate why such concentration on change in average inequality can be misleading. Assume the poverty population in the initial period is 20 percent and due to “pro-poor” growth, the share (in total expenditures) of the first quintile increases, along with the share of the third and fifth quintiles. For reasonable values of changes in shares, an aggregate index of inequality might well show a worsening in the aggregate distribution and therefore a pro-poor growth process would be erroneously dubbed as anti-poor.

*Implication 4:  $\zeta$  ambiguously depends on initial inequality at the poverty line.*

Two points are worth noting. First, that there is no direct expression for initial inequality (even at the poverty line) in equation 9. However, from that one cannot conclude that initial inequality does not matter. The density,  $f(P)$ , is an indicator of inequality; the more congested are the poor near  $P$ , the higher the initial equality at  $P$ . But the elasticity is a product of  $f(P)*P$ .

*Implication 5: Inequality change and growth have the same elasticity*

The most surprising conclusion to emerge from examination of equation (9) is that both economic growth ( $Y'$ ) and inequality change ( $Y_X'$ ) have the *same* elasticity, an elasticity given by the ratio  $SDE_{t-1}/Ho$ . This makes computations of pro-poor growth based on the magnitude of the elasticity  $\zeta$  highly questionable.

The impact of both average expenditure growth, and average change in the share of expenditures of those close to the poverty line, is the *same* and equal to  $SDE_{t-1}/Ho$ . Thus, it is *not* the case that average growth and inequality change have different elasticities. That this “equivalence” must be so is indicated by the following. Growth in expenditures of the poor is the sum of growth from two sources: the mean growth in expenditures of the entire population (this is the popular “headline” growth variable) and the growth in the share of expenditures of the poor (change in inequality but only of those close to the poverty line). Thus, if mean expenditures increase by (log) 10 percent, and inequality, measured as the share in total expenditures of the population close to the *poverty line* worsens by (log) 10 percent, then there will be no change in net income of the poor, and therefore little change in the head-count ratio of poverty.

#### **Section 4: *The Importance of SDE***

In *Imagine*, the use of SDE in explaining the growth-poverty nexus was emphasized. Several reasons were offered to suggest that its use would improve interpretation and understanding of the relationship between poverty, inequality and growth. First, that implicitly SDE is incorporated in the way most economists (and policy makers) think i.e. the value of the SDE yields the magnitude of poverty decline *per se* for a given amount of growth. Even when  $\zeta$  is used, the purpose is always to find the change in poverty,  $dH$ . So why not use a direct measure of  $dH$  rather than use  $\zeta$ , and then derive  $dH$ ?

Thus, if the initial poverty level is estimated to be 28.3 percent of the developing country population (as obtained by the World Bank in 1987), then with 10 percent growth<sup>8</sup>, and *no change in inequality*, and an assumed growth-poverty elasticity of 2, the predicted decline in poverty is expected to be (log) 20 percent, or 4.9 percentage points. Coincidentally, the actual change in poverty decline recorded by the World Bank is exactly this number or 23.4 percent in 1998. Alternatively, the average SDE for developing countries in 1987 was 0.46 (*Imagine*, p. 160). With ten percent growth, the predicted decline in poverty is 4.6 percentage points.

The use of SDE also allows one to ignore changes in inequality and changes in mean growth in computing the decline in poverty. The income change that matters is that occurring at the poverty line, regardless of whether such change comes via an inequality decline, or income growth, or a combination of the two. The magnitude of SDE indicates the degree of *congestion* near the poverty line. It is this congestion that indicates the *true "elasticity"* with respect to growth.

#### *Origins of SDE*

In the US the poverty ratio has stayed relatively constant around 15 percent for the last forty years; it measured 17.3 %, 14.7 %, 12.8 %, 13.4 %, and 12.7% of the population in 1965, 1966, 1968, 1987 and 1998, respectively. This is a remarkably stable share, particularly after the step-down in poverty rates in 1 year, 1965. Per capita incomes during this period have risen at an annualized rate of 2.1 percent; even after worsening

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<sup>8</sup> This is the survey based consumption growth observed for the non-industrialized world for 1987-1998 by Chen-Ravallion(2001).

inequality, the incomes of the poor have risen at an annualized rate of about 1 percent per annum resulting in about a 30 percent increase for the period 1965-1998.

Standard elasticity calculations are not meaningful in explaining the near constancy of the fraction of the poor in the US, but use of SDE does provide a meaningful answer. It turns out that the SDE in the US has been very low throughout this period – at around 0.1. In other words, the congestion around the poverty line of the US population has been small. Thus, even a 30 percent increase in per capita incomes over thirty years will only result in a fall of only three percentage points in the aggregate head-count ratio<sup>9</sup>.

This feature of the US poverty line and its intersection with the distribution of income was recognized at least as early as 1964 by Anderson<sup>10</sup> who even then was perplexed by the slow rate of poverty decline in the US. Using graphical techniques, he showed why the poverty decline in the US was expected to be low (though his eyeballing implicit estimate of SDE for the US is rather high at 0.4 when the true value was closer to 0.15 in the mid-sixties)

“For any of these groups, an increase in median income of about 2.5 per cent would reduce the incidence of poverty by 1 percentage point, judging from the slope of the central portion of Figure IV.....This analysis suggests that movements along the poverty curve corresponding to the existing income distribution will imply a declining rate of reduction of poverty”, Anderson(1964, p. ).

Anderson’s important work, (perhaps because it was on the US), was ignored by development practitioners. Thus, discussion of the impact of the congestion at the poverty line on future poverty reductions did not form part of the calculation of future “anticipated” poverty levels either in the work of Ahluwalia-Carter-Chenery (who forecast poverty in 2000 in 1979), or in the work of Collier-Dollar in 2000 (who were forecasting the impact of aid on poverty decline) or in the very recent work of Chen-Ravallion in 2004 (who have tried to forecast whether the developing world will achieve the Millennium Development Goal of poverty reduction in 2015). However, both the World

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<sup>9</sup> Part of the reason that the predicted fall is higher than actual is because the growth rate assumed is that from national accounts, while the poverty calculations are based on growth rates from sample surveys. See *Imagine* and Bhalla(2004a) for a detailed discussion of the importance and relevance of a declining S/NA ratio for poverty calculations.

<sup>10</sup> I am thankful to Angus Deaton for suggesting this reference.

Bank (1991)<sup>11</sup> report on Malaysia and the first World Bank poverty WDR of 1990, World Bank (1990) emphasized the important role of SDE in near identical language:

The World Bank 1991 report on Malaysia stated:

“Choice of a poverty line dictates the initial level of absolute poverty, which has an important bearing on subsequent achievements..... Since poverty is defined in terms of a simple head-count measure (incomes above or below a fixed income) the decline is dependent on the defined poverty line ..... If there are many people slightly below the poverty line initially, then a relatively small amount of growth can have a large effect on reducing poverty” (p. 82).

The World Bank’s *World Development Report 1990: Poverty and Development* reached a very similar conclusion:

“ For any given increase in the incomes of the poor, the reduction in poverty depends on where the poor are in relation to the poverty line. If they are concentrated just below the line, the increase in their incomes will have a bigger effect on poverty than if they are spread more evenly” (p. 47).

#### *Non-linear estimation necessary for SDE*

Non-linear estimation techniques are necessary to estimate the value of SDE, which maybe an important reason why it has been “ignored” in discussions of the effect of growth on inequality, and has had only limited “circulation” to date. The first estimate of SDE was provided by Kakwani in 1993. Using household level data, he stated, in the Appendix to his paper that:

“to compute the elasticities of the head-count ratio and the Sen index, we need an estimate of the density function  $f(x)$  when  $x=z$  ( $z$  is the poverty line). This estimate can be obtained by fitting an equation of the Lorenz curve (Kakwani(1993), p. 136-137).

Using a very different method of estimating SDE’s, (see *Imagine*) we find almost the same magnitude – 0.0023 for a poverty line of \$1.08 - versus Kakwani’s estimate of 0.0026 for a poverty line of \$1.02. Even though he estimates a value for SDE, Kakwani does not derive the simple “equivalent” relationships noted above; instead he suggests

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<sup>11</sup> This report was on Malaysian income distribution and the work on inequality was done jointly by Homi Kharas and myself.

that the elasticity with respect to income growth is *different* than the elasticity with respect to the change in the distribution. This different than theory result occurs because Kakwani was interested in the elasticity with respect to *aggregate* inequality, not with the elasticity with “inequality” at the poverty line; the latter is very tractable and given by SDE/Ho.

After Kakwani’s 1993 work, the profession again ignored the implications of the SDE. But its use was emphasized by Dubey-Gangopadhyay(1998) and Bhalla(2000) for calculations of Indian poverty; Deaton-Tarozzi(2000) presented estimates of SDE for different states of India for 1987; and *Imagine* computed SDE for all the countries of the world, and for more than 900 household surveys, for 1950-2000.

#### *An intuitive understanding of SDE*

What the SDE-growth relationship suggests (e.g. the US example) is that there can be robust growth in incomes of the poor and yet very little poverty reduction. How is this possible? The following heuristic example is illustrative. Assume the poverty line is 100 and the mean income of the poor is 50 and the standard deviation is 20. An increase in mean consumption of 10 percent will have a near-zero impact on the head count ratio. Now assume that the mean income of the poor was 95. Now a 10 percent increase in mean consumption will lead to a very large decline in the head count ratio. If the poor are congested at a level close to the poverty line, say 99, the elasticity will be close to infinity with the same growth i.e. with virtually no change in the underlying reality – except the change in the location of where the poverty line cuts the distribution of income, or equivalently, except for the “initial condition” of congestion.

**Section 5a: Theory behind the empirics**

While several analysts have reported growth-poverty regressions, most seem to suffer from a possibly fatal flaw. A simple analysis of the estimated growth-poverty elasticity regression, equation 9, can illustrate why this might be the case.

Repeating the equations:

$$[H'/Y'] = \zeta = SDE_{t-1} * (1 + (Y_X'/Y')) / H_{t-1}$$

$$\text{or } H' = \{ SDE_{t-1} / H_{t-1} \} * (Y' + Y_X')$$

$$\text{or } H' = \{ P * f(P_{t-1} / H_{t-1}) \} * (Y' + Y_X')$$

The typical estimated regression looks like this:

$$(11) \quad H' = \hat{a} + \hat{a}_1 * Y' + \hat{a}_2 * I' + \hat{a}_X * X' + e,$$

where  $I'$  refers to the log change in an aggregate inequality variable like the Gini, and  $X$  are other regressors and  $e$  is the error term. There are several major differences between the estimated equation and the correct theoretical specification. The similarities end with the dependent variable (log change in the head count ratio): it is identical between theory and empirics. The problems occur with the independent variables. First, aggregate inequality change,  $I'$  is used in the empirical analysis, when it is change in inequality at the poverty line,  $Y_X'$  which should have been used. Second, there is no role for additional specifications like  $X'$  in the equation, unless it is believed that the measures of income growth and inequality change are highly imperfect measures. Third, both the inequality and income growth changes are affected by initial conditions pertaining to the distribution; most importantly, the regression coefficients involve the *initial* head-count ratio. Since the regression reproduces the average tendency, it will turn out that the coefficient for income growth (the estimate of the elasticity), is a complicated weighted average of the ratio of the density at the poverty line, the poverty line and initial  $H_0$ . Now assume that there are three otherwise identical countries, except that one has an initial poverty level of 10, another 20 and a third 30 percent. The weight

for the first country in the estimation of the elasticity is theoretically 3 times that of the third country. In running such a regression, the assumption is that growth in one country will have the same impact on poverty reduction as growth in another country, *ceteris paribus*. This assumption is clearly violated by standard regressions which ignore the role of the SDE.

One method of obtaining an estimate of the gross-elasticity is to use the *measured* elasticity for each growth spell for each country. For example, for China for the period 1987-98, per-capita consumption grew by (log) 50 percent, and the head-count ratio declined by (log) -79 percent (from 30.4 percent in 1987 to 13.8 percent in 1998). The measured elasticity would be (79/50) or 1.58. But these estimates are for the two end-points 1987 and 1998, while the growth spell analysis involves every household survey. Thus, the growth spells for China are several as there has been a household survey in every year since 1982. The average measured elasticity for all the spells since 1987 is – 1.13. This non-equivalence itself shows how the measurement of the elasticity is contaminated by initial head-count levels.

#### **Section 5b: *Initial Inequality and poverty reduction***

One of the most consistent “findings” in the recent development literature is that poverty reduction is greater, *ceteris paribus*, in more equal economies. The reasoning is assumed to be straightforward so no proof is offered: lower inequality means a higher share of income at a point in time for any given group, say the bottom 20 percent; this implies that a higher share of the same growth will accrue to the poor in the more equal country; this “higher” growth means a higher magnitude of poverty reduction; hence, the simple conclusion that a more equal distribution of income is desirable for poverty reduction. Several documents have offered this logic to advocate a more equal distribution of income as a *desirable* starting point in discussions of poverty reduction.

WDR 1990, p.47: “A 10 percent increase in the incomes of the poor in Bangladesh and India would reduce the incidence of poverty by about 7 percentage points. *Where the distribution of income is more unequal*, as in Venezuela and Brazil, the corresponding figure would be only 3 percentage points” (emphasis added).

WDR 2000/01: “High initial inequality reduces the poverty impact of a given rate economic growth. ....Even when the distribution of income itself does not change with growth, countries, with similar rates of growth can have very different poverty outcomes, depending on their initial inequality. Others things being the same, growth leads to less

poverty reduction in unequal societies than in egalitarian ones. If poor people get a small share of existing income and if inequality is unchanged, they will also get a small share of the new income generated by growth, muting the effects of growth on poverty. Evidence confirms this: when initial inequality is low, growth reduces poverty nearly twice as much as when inequality is high". (World Bank(2000, p55))

Ravallion(2001, p. 15): "Even if inequality is not rising, a high initial level of inequality can stifle prospects for pro-poor growth".

Klasen(2001,p.3) "A given rate of pro-poor growth will lead to different rates of poverty reduction, *depending on the level of initial inequality*" (emphasis added)

Datt-Ravallion (2002, p. ]: Household survey data for developing countries suggest that initial distribution does matter to how much the poor share in rising average incomes; higher initial inequality tends to reduce the impact of growth on absolute poverty. By the same token, higher inequality diminishes the adverse impact on the poor of overall contraction.

The above quotes/reasoning betray a confusion between levels and changes. History determines the level of inequality and poverty at a point in time; changes determine changes. What the authors ignore is that regardless of initial inequality, the *change in poverty* is a function of the *change in consumption at the poverty line*. If inequality does not change (as assumed in the above quotes) then growth cannot have a differential impact. For, when inequality stays constant, **the same amount of growth will result in the same increase in the consumption of the bottom 20 or bottom 40 percent or the top 1 percent – not a differential increase as presumed by the authors.** So if a person consumed just below \$ 1 a day per capita in 1987 in unequal Brazil or equal India, and if both societies experienced a 10 percent change in average consumption, then in both societies the poor person would be consuming \$1.10 in 1998, and in both societies the person would be non-poor in 1998; i.e. initial inequality is irrelevant for conclusions about the impact on poverty of growth.

*Varying growth-poverty elasticities due to varying SDE – examples of Brazil, China, India*

That inequality may not be relevant for poverty reduction can also be illustrated by examining the data for three large economies – Brazil, China and India. The three economies also have different historical inequalities – from very high in Brazil, to relatively high in China to relatively low in India. The magnitude of poverty reduction in each society is a function of its SDE – which in turn is a function of the poverty line and

the density at the poverty line i.e. a function of the SDE. The question is – empirically, is poverty reduction a function of the inequality state in each country?

Brazil: No, because even unequal societies like Brazil can have “zones” where equality is not so unequal. For example, the bottom 20 percent in Brazil may have only 5 percent of total income, but all these 20 percent could have great equality and have the same low level of income; and when such incomes are close to the poverty line, the clustering will cause the poverty reducing potency of growth (the elasticity) to be very large. In the late sixties, 10 percent growth in Brazil led to a poverty decline (in percentage points) of 3.1 percent; in the nineties, if the same growth had occurred, and with no change in inequality, the poverty decline would have been only 2.2 percentage points.

India: In the early eighties, each 10 percent growth led to 8 percentage points decline in poverty; in the late nineties, the expected decline, *ceteris paribus*, was also 8 percentage points.

China: With a Gini of 27.8, China was a very equal economy in the early eighties. At that time, each 10 percent increase in incomes led to a 5.9 percent decline in the HCR. A decade later, income distribution in China became more unequal; but the same amount of growth now led to a *larger* decline in the HCR, 7.6 percent, (because the distribution *around the poverty line* was now more equal) . China is more equal than Brazil, yet in the late nineties, and with the national poverty line, China would need higher growth to bring down poverty by an equivalent amount.

What the examples of India, China and Brazil illustrate is that the *same* amount of economic growth, in the *same* or different countries, for the *same* or different poverty lines, for the *same* or different initial inequality levels, and for the same or different “quality” of growth, can lead to similar or different poverty declines. For example, in 1996, the SDE for Brazil was equal to 0.25 for the \$1.08 poverty line, not much different than the SDE of 0.27 for the considerably higher national line of PPP\$ 2.3 per capita per day. Income inequality in China jumped from a Gini of 24.2 in 1984 to a Gini of 33.2 in 1985 – yet the SDE for the national poverty line (0.9 PPP\$) increased from 0.69 to 0.72! In India, aggregate consumption inequality has stayed constant for the last sixteen years (1983, 1987, 1993 and 1999, the years of the large National Sample Surveys – see

Bhalla(2004a). The SDE according to the \$1.08 a day has stayed constant at around 0.79, but the SDE for the \$2 a day line *increased* from 0.33 in 1983 to 0.46 in 1999. In poverty reduction terms, for the same poverty line, and the same distribution of expenditures, 10 percent growth would have led to only a 3.3 percentage point decline in the poverty rate in India in 1983, but a much higher decline of 4.6 percentage points in 1999. And if a lower poverty line is considered, the growth process would have been viewed as significantly pro-poor since the poverty reduction would be almost double (7.9 percentage points) for the same amount of growth. These statistics highlight the dangers of not adjusting for SDE – same amount of growth, no change in the distribution, yet radically different outcomes – and false interpretations.

## **Section 6: Pro-poor growth – how should it be measured?**<sup>12</sup>

Knowledge about the shape of the distribution elasticity has an important side-benefit – it can help assess whether a particular growth process was pro-poor or not. It is important to establish a proper measure for “pro-poor” growth. Most existing indices essentially rely on an assessment of whether inequality has improved or not. If it has, then growth was pro-poor. But this simple indicator is inadequate because it will show a growth process to be pro-poor even if the poor suffered a decline in their absolute income (as long as the non-poor suffered an even bigger decline in their per-capita income). Further inadequacy of this index is dictated by the experience of countries like China; such countries show a large increase in inequality (hence growth is not considered pro-poor) but also a very large increase in the incomes of the poor (so growth should be considered pro-poor).

It was recognition of such inadequacies that led *Imagine* to offer some straightforward definitions of pro-poor growth. One suggested measure was to evaluate the growth in expenditures of the poor *relative* to the growth in expenditures of the non-poor: “Propoor growth is identified as such when the growth in incomes of the poor people exceeds the growth in incomes of non-poor people” (*Imagine*, p. 153). For the period 1980-2000, each 10 percent growth of the non-poor in the developing world was accompanied by an 18 percent increase in expenditures of the non-poor – thus, growth in the developing world should be considered pro-poor. By definition, this index is equivalent to the nature of inequality change that has occurred; the difference between this index, and the traditional inequality measure is small but not irrelevant. The *Imagine* measured inequality change is different than that yielded by an aggregate measure like the Gini in that it is centered on the relative change in not all incomes (change in Gini), but just in the incomes of the poor.

But this index is not that useful for cross-country comparisons because one country (e.g. China) can have higher absolute growth of the poor compared to another, yet have the within country incomes of the poor grow at a lower rate than the within country non-poor. This problem was acknowledged in *Imagine* and it was conjectured that all that should matter is the absolute growth in incomes of the poor:

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<sup>12</sup> This section borrows from Bhalla(2004c).

“Ultimately, concern is (or should be) with poor people’s incomes, and whether such an increase comes about through increasing inequality should not be a concern of those who are concerned about improving the lives of poor people” (*Imagine*, p.152).

But even this additional simple definition of pro-poor growth – growth in incomes of the poor - has its drawbacks. If concern is with poverty (head count ratio) reduction, then the magnitude of *reduction in poverty* might be of greater interest than the growth in incomes of the poor e.g. if 20 percent of the population is poor and living below a \$ a day, and if most of the poor are centered around 75 cents, then a large 10 percent increase in incomes of the poor might make very little dent on the aggregate measure of poverty. So one might argue that the simple change in the head-count ratio of poverty is an adequate index of pro-poor growth – larger the decline, larger the index of pro-poor growth.

But even this index is deficient in that it does not adjust for the initial condition of congestion near the poverty line. Knowledge of SDE can help. The following two steps lead to an improved definition and evaluation of pro-poor growth. Since the problem is one of differing values of SDE, the adjustment required is to compare the poverty reduction that would have occurred if all the countries had the *same* SDE, e.g. unity. The proposed index of pro-poor growth is therefore to divide the actual poverty decline that occurs (dH in percentage points) by the country specific SDE in the previous period. This conversion creates a “level playing field” and provides an estimate of how much poverty reduction took place according to a common standard. For example, if country A had 10 percent poor in the initial period, and had an SDE value of 0.5, and poverty reduced by 5 percentage points, then the “standard” poverty reduction was equal to 5 divided by SDE or 10 percentage points. This is deemed equivalent to another country which reduced its poverty by 10 percentage points, but whose initial SDE was equal to unity.

Yet another, and perhaps the most popular, approach to the measurement of pro-poor growth has been via the examination of the *elasticity* of poverty reduction with respect to growth – the higher this elasticity the more “favorable” the growth process to poverty reduction. However, (as emphasized in *Imagine* and above), this measure is severely deficient. Low poverty countries automatically show a high elasticity, even if all initial conditions are identical! Hence, the elasticity measure penalizes countries who have

high poverty to begin with – by definition, no magnitude of growth in such an economy can be more “pro-poor” than highly unequal growth in a low poverty country.

Summarizing, in theory, there are at least *nine* possible measures of pro-poor growth. The first and originally the most popular measure is the growth rate in per capita consumption (economic growth). There are two possible measures of such growth – that measured from survey data and that measured from national accounts data. While the two sources revealed similar growth till the late seventies, the period eighties onwards was witness to a sharp decline in the survey growth rate (relative to the national accounts growth rate). What has been argued in *Imagine* (and Bhalla(2003b, 2004b) is that analysts should be consistent – growth and poverty reduction should be derived from the same growth definition. The third measure of growth is the growth experienced by the poor population (as argued in *Imagine* and Chen-Ravallion(2003).

Change in inequality can be measured in four different ways: first, as the change in an overall index of inequality e.g. Gini or variance in logs; second as the change in the share of expenditures of the first quintile of the population (e.g. the definition used by Dollar-Kraay); third, as the ratio of growth in incomes of the poor relative to growth in incomes of the non-poor; fourth, as the change in the share of expenditures of not any arbitrary quintile, but rather as the change in the share of the poor – with this fraction being kept constant at the level prevailing in some base year (Bhalla(2002) chooses 1987 as the base year while this paper chooses 1980<sup>13</sup>.)

In addition to these seven measures, pro-poor growth is proxied by two poverty decline measures - the unadjusted decline in the head-count ratio of poverty, and the “new” measure detailed above, the decline in poverty adjusted for SDE.

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<sup>13</sup> As is standard practice, inequality data from the most recent preceding year (failing which, the most recent following year) to 1980 is taken as proxy for 1980 when no household survey was conducted in 1980. Countries with data for only one survey year were dropped from the analysis.

### ***Section 7: Empirical Results on the triangle***

Various tests of the poverty-inequality-growth relationship are reported below. Some tests are as they appear in the literature; some others are new. Theory already indicated the kind of relationship we should expect. Poverty reduction should be strongly related to growth; initial inequality may affect future growth; but it is only weakly, and indirectly, related to poverty reduction. Growth may, or may not, affect future inequality.

These hypothesis are tested using an extended Imagine data set. This large and corrected data set (see below) yields survey based distribution information for almost 140 countries – 55 with primarily expenditure distribution data and 83 with primarily income distribution data. There is information for 948 surveys – 248 for expenditure distribution and 699 for income distribution. Over two-thirds of these surveys were conducted in the post 1979 period – 214 expenditure surveys and 417 income surveys. It is possible that this is the largest data used to date for the kind of empirical exercises conducted in this paper.

#### ***Side 1: Inequality and Growth***

Co-incident with the concern with pro-poor growth has been an intensified interest in the relationship between initial inequality and subsequent growth. This was an ‘old’ concern of development economists in the sixties and seventies, in reaction to the finding of Kuznets(1955) that inequality increased with development before subsequently declining – the famous inverted-U hypothesis. The new research has a twist in that independent of the trend dictated by the Kuznets curve, initially more equal societies are associated with higher levels of growth. The same Kuznets pattern might occur, but the growth path will be higher in more equal societies, *ceteris paribus*.

This is also in contradiction with the old school of thought which associated high savings rates, and therefore high investment rates and therefore higher growth, with greater inequality. The new inequality-growth theory is that primarily because of imperfect capital markets which affect the poor, the investment rate is lower in unequal economies, and hence the growth rate is lower. Thus, higher inequality means lower growth.

It ultimately is an empirical issue and the testing of initial inequality-future growth regressions have run into the same pitfalls as the early growth regressions. The latter

was investigated in detail by Levine-Renelt in 1993. This influential paper found that cross-country growth regressions yielded almost any desired result, and that the coefficients of selected variables were very sensitive to country selection, other variable selection, time-period selection etc. While true with the early research, the lack of robustness is no longer a phenomenon with growth regressions (see Bosworth-Collins(2003)). Researchers are increasingly finding robust coefficients for several variables (e.g. the fiscal deficit), regardless of specification and/or data issues. (See Bhalla(2004a) for a detailed investigation).

If published results are a criterion, then it appears as if initial equality equals higher growth is the prevailing “conventional wisdom”. This *empirical* “result” should not be a surprise, especially for the globalization post-seventies period when the economies of Latin America and sub-Saharan Africa showed virtually no growth, and often declining growth. With hardly any exceptions, these two continents also coincidentally have the highest initial inequality, no matter how measured. And these two continents contain about two-thirds of all developing countries world (excluding Eastern Europe). Initial inequality lowering future growth advocates have not satisfactorily answered the “problems” caused by this statistical association.

#### *Inequality data*

The data base used by most of these studies is the Deininger-Squire inequality data set, and within it, the high quality observations. Distribution data are obtained from household surveys and several countries conduct only income surveys (e.g. China, and most Latin American countries), or conduct only consumption surveys (e.g. most of Asia and sub-saharan Africa). This causes a problem for analysis since it is well known, and well understood, that income inequality is higher than consumption inequality. The approximation used by Deininger-Squire (and Berry et. al. (1981)) is to add 6.6 Gini points to consumption inequality indices to make them “conform” to income inequality data. This is also the practice followed by others e.g. Banerjee-Duflo, Forbes.

In *Imagine*, the distributions contained in the various data sources (e.g. Deininger-Squire, WIDER, ADB poverty research project etc.) were pooled to construct inequality

indices from information on just quintile shares<sup>14</sup>. In particular, the Kakwani(1980) suggested procedure - of constructing percentile distributions from quintile and/or grouped data - was modified to ensure that the ex-post quintile shares matched the ex-ante inputted quintile shares.<sup>15</sup> An interesting by-product of this exercise was that several inconsistencies in both the Deininger-Squire and WIDER data sets were identified i.e. that the aggregate inequality indices like the published Ginis were not consistent with the published quintile shares.

Table 1 reports the results for very simple growth regressions for the period 1960-2000. Three sets of results are presented – one each for the periods 1960-80, 1980-2000 and 1960-2000. Within each set, two regressions are reported – one the “base” regression (Model I) with control variables initial per capita income, and share of fiscal deficit in GDP; and the second model (Model II) incorporates the variables in the base regression plus two geography variables, the latitude and longitude of the country. Within each model, three separate initial inequality variables were tried – income inequality as measured by Gini and consumption surveys adjusted as per *Imagine (Inequality I)*; *adjusted* income inequality with consumption Ginis ratcheted upwards by adding 6.6 (Inequality II) and consumption inequality Ginis (with quintiles adjusted for income surveys, as in *Imagine, Inequality III*).

Notwithstanding the large number of “tests”, for the 1960-80 period, there is no model which yields a significant coefficient for income inequality; indeed the highest significance (and that to of the “wrong” positive sign) is obtained with adjusted income inequality. This period was also when both Latin America and SSA grew at reasonable rates (recall that these import substituting years were also witness to the Brazilian miracle). For the 1980-2000 period, initial inequality is significant and negative (most likely because of the joint LA-SSA effect - large number of countries, large inequality levels, low economic growth). However, for both income inequality indices, the significance disappears with the mere addition of the exogenous latitude and longitude variables. The consumption inequality variable retains its significance; however, with the

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<sup>14</sup> Somewhat surprisingly, for several countries, the quintile shares reported in Deininger-Squire did not pass the simple consistency check of a higher order quintile having a higher share of income than a lower order quintile.

<sup>15</sup> The unmodified method would result in the (computed) sum of the quintile shares being either greater or less than 1.

Table 1: Relationship between initial inequality and Growth

<b>Model 1: With initial inequality and share of fiscal deficit in GDP as “control’ variables</b>			
<b>Dependent Variable:</b>	<b>Annualized growth rate of p.c. GDP(constant \$)</b>		
	<b>1960-1980</b>	<b>1980-2000</b>	<b>1960-2000</b>
<b>Inequality 1</b>			
Coefficient	0.0097	-0.0521	-0.0464
t-value	0.42	-3.09	-2.64
<b>Inequality 2</b>			
Coefficient	0.0058	-0.0528	-0.0487
t-value	0.29	-3.73	-3.33
<b>Inequality 3</b>			
Coefficient	-0.0032	-0.0748	-0.0666
t-value	-0.11	-3.72	-3.08
<b>Model 2: Above control variables plus 2 geography variables:- Latitude and Longitude</b>			
<b>Dependent Variable:</b>	<b>Annualized growth rate of p.c. GDP(constant \$)</b>		
	<b>1960-1980</b>	<b>1980-2000</b>	<b>1960-2000</b>
<b>Inequality 1</b>			
Coefficient	0.0277	-0.0327	-0.0195
t-value	1.10	-1.52	-1.01
<b>Inequality 2</b>			
Coefficient	0.0353	-0.0263	-0.0186
t-value	1.52	-1.51	-1.14
<b>Inequality 3</b>			
Coefficient	0.0213	-0.0617	-0.0358
t-value	0.67	-2.61	-1.53

Source: Household surveys, 1950-2000, see *Imagine*.

Notes:

- There are three inequality variables:  
*Inequality 1*: Income Gini in the initial year (1960 or 1980) with adjustments made for consumption distributions from quintile data – see *Imagine*.  
*Inequality 2*: Income Gini in the initial year with a constant 6.6 addition for consumption distributions (see Forbes, Banerjee-Duflo, Deininger-Squire, Berry et. al. (1981))  
*Inequality 3*: Consumption Gini in the initial year (1960 or 1980) with adjustments made for consumption distribution from quintile data – see *Imagine*.

addition of regional dummies, its magnitude drops to only  $-0.02$  (from  $-0.06$ ) and the coefficient becomes completely insignificant (t statistic of  $-0.94$  from  $-2.61$  without regional dummies).

More tests perhaps need to be conducted to test for the robustness of the conclusion that initial inequality does not impact future growth. But the initial results, with an expanded data set, do tend to support the conclusion that initial inequality is irrelevant in determining future growth.

### *Triangle Side 2: Growth and Poverty Reduction*

There is not much debate on the significance of this relationship, but there is considerable debate on its magnitude. The conventional method of estimating the growth-poverty relationship is to regress the percentage change in the head-count ratio (the dependent variable) on the percentage change in mean expenditure growth, and percentage change in an inequality index like the Gini. This has yielded published estimates as high as  $-3.7$  and according to Collier-Dollar a mean of about  $-2$  is what various alternative models offer. Datt-Ravallion carry out various specifications for the different states of India and derive very strong implications about the relative performance of different states based on the estimated elasticity.

“Perhaps the most striking finding [from Table 3] is the variation in the elasticity of poverty with respect to nonagricultural output. The (absolute) elasticities vary from a low  $0.26$  in Bihar to a high of  $1.33$  in Kerala..... Why does poverty respond so much less to economic growth in some states than in others? ...A plausible explanation, with some support from cross-country regressions, is that certain types of initial inequalities can severely impede the prospects for growth-mediated poverty reduction... For example, pervasive credit market imperfections and *greater initial inequality of assets* (particularly of land) can mean that the growth that does occur reduces poverty by less. [2002, emphasis added, p. ]

Theory informs us that the determinants of the percentage decline in monetary poverty are provided by equation (9):

$$(9) \quad (dH/Ho) = [-P^*f(P)^*(Y'_x + Y'_m)] / Ho$$

Various authors estimate equation (11):

$$(11) \quad H' = \hat{a} + \hat{a}_1 * Y' + \hat{a}_2 * I' + \hat{a}_x * X' + e,$$

Simple comparison of the above two equations yields several results. First, estimating equation (9) is not recommended “econometrically” since the same term, Ho, is entered on both sides of the equation i.e. a relationship is assured, and the problems magnify if Ho is measured with error (as it most likely is). Second, the elasticity is higher for a lower initial level of Ho. Thus estimation of equation 11 results in at least two problems: (a) that the estimated elasticity,  $\zeta$ , cannot be interpreted as revealing “good” pro-poor growth, as done above by Datt-Ravallion; and (b) that estimation and interpretation is severely affected at low levels of Ho. For example, if Ho is 5 percent and if in two years the level is reduced to 3 percent, then this would imply a very large 40 percent gain. Now if mean growth that brought this about was 1 percent and if there was an increase of 2 percent in the share of incomes of the poor, then the estimated growth-poverty elasticity would be very high – about –13 – and considerably higher than the presumed average elasticity of 2.

The coefficient of expenditure growth (in equation 9) is known ex-ante i.e. it is the product of the poverty line and the density function in the previous period, and given by  $SDE_{t-1}$ . If equation (3') is estimated (as done below), then the mean expenditure growth, and the change in expenditure shares of the poor, have to be multiplied by  $SDE_{t-1}$  prior to running the regression. If not, then there will be a specification error i.e. the regressors need to be “weighted” by initial SDE. Growth rates of different countries (or the same country in a different period) are expected to have a differential effect depending on the congestion near the poverty line (as illustrated by Anderson for the case of the US). Non multiplication by the initial SDE is tantamount to the highly unrealistic assumption that growth has the same effect all the time, regardless of the statistical properties of initial

inequality and the nature of the intersection of the poverty line with respect to the distribution.

Table 2 presents three sets of results for four different poverty lines using survey data. As documented extensively in Bhalla(2004a) and *Imagine*, the survey capture yielded by household surveys has been declining in the eighties and nineties. Household survey mean has been falling behind the corresponding NA mean with the result that the growth rate yielded by survey data for a large set of countries is below *half* the recorded NA growth rates. This will naturally cause a bias in the reported poverty statistics, and therefore rather than lack of quality or pro-poor growth, the decline in the impact of *NA growth* (Peter's growth) on survey poverty decline (reduction in Paul's poverty) may simply be a function of the fact that the recorded survey growth was considerably lower than the NA growth rate. Rather than be distracted by the Survey vs. NA debate, all the relevant tests/models have been conducted with growth and poverty declines consistently taken from surveys.

The three set of results within each poverty line refer to (i) the conventional poverty-elasticity estimated with log decline in poverty as the dependent variable and log average expenditure growth and log change in Gini as the two independent variables. The first regression (for each poverty line) is the conventional model with conventional variables i.e. log poverty decline as a function of log growth in mean expenditures and log change in aggregate inequality (Gini). The second regression changes the dependent variable – it is now the arithmetic change in poverty decline (dH instead of H'). The third regression also has dH' as the dependent variable, but instead of aggregate inequality change, inequality change at the poverty line (share in expenditures of the poor) is used. Further, both independent variables are adjusted by lagged SDE.

Several results emerge. First, the explanatory power of the first difference model is (almost) always considerably greater than the old log growth model . Second, the estimate of the growth-poverty elasticity is in the range of  $-1.3$  to  $-1.5$  for the four different poverty lines. Third, the quasi-elasticity obtained with the first difference equations is in the  $-0.45$  to  $-0.55$  range for the unadjusted

**Table 2: Growth poverty relationship - Survey data**

	Dep Var	Coefficient	t-value	R - bar squared
<b>Poverty line = PPP \$1.08 p.c.p.d.</b>				
<b>(nobs=181)</b>	H'			0.61
Consumption growth		-1.50	-14.7	
Inequality growth (Gini)		-0.94	-5.7	
Constant		-0.69	-0.8	
<b>(nobs=181)</b>	dH			0.77
Consumption growth		-0.44	-21.7	
Inequality growth (poor)		-0.16	-7.4	
Constant		0.05	0.3	
<b>(nobs=181)</b>	dH			0.86
Adj. Consumption growth		-0.87	-28.7	
Adj. Inequality growth (poor)		-0.46	-10.9	
Constant		0.08	0.6	
<b>Poverty line = PPP \$1.30 p.c.p.d.</b>				
<b>(nobs=211)</b>	H'			0.61
Consumption growth		-1.27	-24.0	
Inequality growth (Gini)		-0.98	-8.7	
Constant		-0.78	0.1	
<b>(nobs=211)</b>	dH			0.77
Consumption growth		-0.45	-24.0	
Inequality growth (poor)		-0.18	-8.7	
Constant		0.01	0.1	
<b>(nobs=211)</b>	dH			0.88
Adj. Consumption growth		-0.86	-34.5	
Adj. Inequality growth (poor)		-0.53	-13.5	
Constant		-0.02	-0.2	

Source: Household surveys, 1950-2000, see *Imagine*(2002), Bhalla and Associates(2003)

Notes: 1) Sample includes only those economies for which the poverty level is greater than 5 percent for the particular poverty line.

2) the dependent variable is either the log change in poverty (H') or the first difference in poverty levels (dH').

3) Inequality growth (Gini) refers to aggregate inequality change, while inequality growth (poor) refers to the log change in the share of the poor, where the "base" share is that prevailing in 1980.

**Table 2 (contd): Growth poverty relationship - Survey data**

<b>Poverty line = PPP \$2.00 p.c.p.d.</b>	Dep Var	Coefficient	t-value	R - bar squared
<b>(nobs=291)</b>	H'			0.57
Consumption growth		-1.25	-15.5	
Inequality growth (Gini)		-1.06	-8.1	
Constant		-0.85	-1.2	
<b>(nobs=291)</b>	dH			0.82
Consumption growth		-0.46	-34.8	
Inequality growth (poor)		-0.13	-10.3	
Constant		-0.08	-0.6	
<b>(nobs=291)</b>	dH			0.88
Adj. Consumption growth		-0.95	-45.1	
Adj. Inequality growth (poor)		-0.40	-13.7	
Constant		-0.10	-1.0	

  

<b>Poverty line = PPP NPL p.c.p.d</b>	Dep Var	Coefficient	t-value	R - bar squared
<b>(nobs=571)</b>	H'			0.55
Consumption growth		-1.42	-20.9	
Inequality growth (Gini)		-0.98	-14.1	
Constant		0.68	1.2	
<b>(nobs=571)</b>	dH			0.60
Consumption growth		-0.55	-27.3	
Inequality growth (poor)		-0.15	-10.3	
Constant		0.41	2.5	
<b>(nobs=571)</b>	dH			0.60
Adj. Consumption growth		-1.01	-27.4	
Adj. Inequality growth (poor)		-0.31	-10.3	
Constant		0.46	2.75	

data, and about  $-0.9$  to  $-1.0$  for the adjusted data. Fourth, the coefficient for inequality change in the adjusted data is *not* equal to the coefficient for mean growth (as dictated by theory) but considerably lower (about  $-0.3$  to  $-0.5$ ).

The first difference equations can be used to derive the growth-poverty elasticity by using the coefficient on income growth and dividing it by the HCR in the initial period. The average poverty rate is around 0.3; a consumption growth rate coefficient of around  $-0.3$  yields the poverty-growth elasticity of about  $-1$ . But if the average level of poverty is taken as 0.2, then the “average” elasticity jumps to  $-1.5$ . This illustrates how the growth-poverty elasticity is a function of the poverty line (higher levels of elasticity for lower poverty lines). And how the elasticity dynamically changes and becomes higher in the nineties (lower poverty levels) than in the eighties and that in turn is higher than the elasticity observed in the seventies, and so on.

The adjusted coefficient in the dH equation is very constant around  $-0.9$  and close to the theoretically expected value of  $-1.0$ . What this estimate suggests is that growth has similar effects once the data are adjusted for the congestion at the poverty line i.e. the SDE in the initial period. The coefficient on inequality change is considerably lower than the coefficient on mean expenditure growth – this is somewhat to be expected since the measurement error is higher for inequality i.e. it is inequality at the poverty line, whereas the approximation used in the empirical work is the change in inequality of all the poor below the poverty line.

### *Triangle Side 3: Inequality and Poverty reduction*

#### *Inequality and poverty reduction – any relationship*

A simple method to test the relationship between inequality and poverty reduction is as follows: regress the observed poverty-growth elasticity on initial inequality and see if the coefficient is significant. But what is initial income inequality? Two estimates were tested. First, the inequality as observed in 1980 (for poverty reduction post 1980, and the second is the initial inequality as that prevailing on the starting date of any growth spell (e.g. if two surveys were conducted in 1982 and 1985, then the elasticity observed between 1982 and 1985 is regressed on the inequality observed in 1982).

Table 3: Does initial inequality affect growth poverty elasticity?

<b>Survey data</b>							
<b>Initial inequality</b>	Observations	<b>Model1</b>			<b>Model2</b>		
		Coefficient	t-value	R-squared	Coefficient	t-value	R-squared
Poverty line = 1.08	182	0.40	1.37	0.0048	0.45	1.89	0.0140
Poverty line= 1.30	202	0.26	1.32	0.0037	0.30	1.88	0.0124
Poverty line= 2	267	0.04	0.37	-0.0033	0.64	0.64	-0.0022
Poverty Line National	466	0.11	1.02	0.0001	0.11	1.30	0.0015

  

<b>National Accounts Data</b>							
<b>Initial inequality</b>	Observations	<b>Model1</b>			<b>Model2</b>		
		Coefficient	t-value	R-squared	Coefficient	t-value	R-squared
Poverty line = 1.08	184	-0.23	-1.22	0.0023	0.02	0.11	-0.0054
Poverty line= 1.30	214	-0.10	-0.78	-0.0018	0.04	0.38	-0.0040
Poverty line= 2	265	-0.04	-0.56	-0.0026	0.03	0.51	-0.0028
Poverty Line National	464	0.09	0.76	-0.0009	0.05	0.46	-0.0017

Source: Household surveys, 1950-2000, see *Imagine*(2002), Bhalla and Associates(2003)

Notes:

1. Both Model 1 and 2 have the observed growth poverty elasticities as dependent variable
2. Model 1 – With *Income Gini* (adjusted by quintile share) in 1980 as independent variable. Model2 – With *Income gini* (adjusted by quintile share in 1980 ) in the initial year of the growth spell as independent variable.

As Section 2 documented, theory does not suggest any relationship between initial inequality and subsequent poverty reduction. The results presented in Table 3 confirms this expectation. In this table, Model 1 is a regression of the observed elasticity (i.e.  $H'/Y'$  observed for any growth spell) and initial consumption inequality as that prevailing in 1980; and Model II has initial inequality as that prevailing at the beginning of each growth spell.

The results suggest that regardless of the poverty line used, initial inequality has **no** empirical relationship with poverty reduction. The coefficient on initial inequality is hardly significant and the highest t-statistic reported is 1.89 for poverty line equal to 1.08. The value of the coefficient is 0.45, and it has the wrong sign i.e. higher initial inequality, higher the growth-inequality elasticity!

There is a summary measure that can be used to estimate the average impact of inequality on poverty change. Using data on expenditure growth and inequality change (share of the poor), estimates of the *average* contribution of growth and inequality to the observed average decline in poverty can be computed. Table 4 reports on these estimates – both the average contribution and the share is reported. Two important results emerge – on a per country basis, inequality did worsen during the period 1980-2000 – the contribution of the inequality share is positive i.e. inequality changes, on average, have led to an increase in poverty, *ceteris paribus*. This result, in contradiction to Deinger-Squire and Dollar-Kraay, has also been reported by Cornia and *Imagine*. Second, the share of inequality change in explaining the actual poverty decline that took place is very, very small – in the range of 1 to 14 percent. (For the eight estimates reported, the average share is only 6.1 percent). In other words, of the total decline in poverty that was observed for 1980-2000 was 10 percentage points, the fact that inequality worsened led to an increase in poverty than would otherwise have been observed of only 0.6 percentage points. This result is at significant variance with the theoretical results obtained: e.g. Bourguignon(2004) who states that “It is important to consider growth and income distribution simultaneously and to recognize that *income distribution matters as much as growth for poverty reduction*”, (emphasis added).

Table 4 : Contribution of Growth and Inequality to poverty reduction

Survey Data	Average Contribution		Average Share	
	Growth	Inequality	Growth	Inequality
Poverty Lines				
PPP \$ 1.08	-0.66	0.04	-106.4	6.4
PPP \$ 1.30	-0.74	0.09	-113.4	13.4
PPP \$ 2.00	-0.82	0.01	-101.1	1.1
PPP \$ National	-0.93	0.10	-112.1	12.1

NA data	Average Contribution		Average Share	
	Growth	Inequality	Growth	Inequality
Poverty Lines				
PPP \$ 1.08	-0.87	0.05	-106.1	6.1
PPP \$ 1.30	-0.99	0.10	-111.2	11.2
PPP \$ 2.00	-0.87	0.02	-102.4	2.4
PPP \$ National	-0.93	0.08	-109.4	9.4

Source: Household surveys, 1950-2000, see *Imagine*(2002), Bhalla and Associates(2003)

Notes: 1) Only poverty changes for economies whose level of poverty (according to the line chosen) is above 5 percent were chosen.

2) The contribution has been estimated from the regression equation which has the arithmetic change in poverty as the dependent variable and the expenditure growth and log change in gini as the independent variables.

*Some more results on the growth-poverty elasticity*

As stated in section 2, the growth-poverty elasticity for period  $t+1$  can be estimated *ex-ante* as the ratio of the SDE and the observed poverty level in period  $t$ . It can also be measured as the ratio of the observed (log) decline in poverty and expenditure growth. Table 5 reports the summary statistics.

The results are striking in their rejection of the conventional method of estimating the growth poverty elasticity. The standard elasticity has much higher variance, more extreme values, and a *positive* mean! (at least for the \$1.08 poverty line). The theoretically suggested elasticity measure (lagged SDE divided by the lagged head-count ratio) seems to be much better-behaved, and indicates an average of  $-2.04$  for the \$1.08 line, and  $-1.8$  for the national poverty line.

Table 5: Sample means, growth spells, 1980-2000, survey data

Variables	Observations	Mean	Standard Dev.	Minimum	Maximum
Expenditure growth (a)	135	1.66	9.24	-40.5	44.3
Expenditure growth (f)	401	1.48	9.18	-40.5	64.4
Growth in share of poor (a)	135	-0.41	7.74	-34.7	27.4
Shape of distribution elasticity (a)	135	0.45	0.22	0.15	1.03
Growth in share of poor (f)	401	-0.41	11.4	-72.1	58.6
Shape of distribution elasticity (f)	401	0.52	0.17	0.21	1.0
Conventional elasticity estimate (a)	135	1.06	35.3	-180.8	352.0
New elasticity estimates (a)	135	-2.04	1.17	-6.05	-0.34
Conventional elasticity estimate (f)	401	-1.58	19.4	-183.9	181.9
New elasticity estimates (f)	401	-1.80	1.02	-5.8	-0.29

Notes:

1. The subscripts a and f refer to the \$1.08 and the national poverty line, respectively.
2. Conventional elasticity estimate is the ratio of the observed poverty decline and the observed increase in per-capita expenditures (both numbers in logs).
3. The new elasticity estimate is the shape of the distribution elasticity observed in the earlier period divided by the poverty rate of that period.
4. The poor are defined as the fraction poor in the base year, 1980.

### *Outside the triangle : Pro-poor growth*<sup>16</sup>

Tables 6 and 7 report the nine measures of pro-poor growth and the ranks for these indices for countries of the developing world for the period 1980-2000. Table 8 reports the correlations. The results indicate that economic growth is the most important determinant of poverty change, with inequality change a very distant second. Further, virtually all income growth measures (including the most common measure – growth in average income) yield near identical results, and results which are not at all dissimilar from those obtained via the index of adjusted poverty decline. Some specific results:

1. The inequality change indicators are very weakly correlated with both growth in average expenditures (whether measured by survey or national accounts growth), and poverty decline (whether measured by actual poverty decline or adjusted (by SDE) poverty decline). The most significant inequality change variable is the change in shares of the bottom 40 percent – about 0.1 with respect to average income growth and 0.11 with respect to adjusted poverty decline. The correlation drops to only 0.04 with unadjusted poverty decline. These low correlations are somewhat of a surprise given the contention by some (e.g. Bourguignon(2004)) that inequality change is an important contributor to poverty decline “It is important to consider growth and income distribution *simultaneously* and to recognize that income distribution matters as much as growth for poverty reduction” (emphasis in original, 2004, p. 11).
2. Expenditure growth per se gives almost identical results to both expenditure growth for the poor and poverty decline. China emerges as the country with the most pro-poor growth (and Indonesia as second) according to all the expenditure growth variables, as well as poverty reduction. Only for unadjusted poverty reduction does China emerge in second place with Indonesia as first.
3. The difference that the level of SDE makes is indicated by the columns for actual and “adjusted” poverty decline. For example, China’s actual poverty decline between 1980 and 2000 was “only” 41 percentage points, only a few percentage points more than India. But the adjusted declines for the two countries was 70 percentage points (China) vs. 42 percentage points (India) i.e. the “adjusted” or “equivalent” poverty decline in China was considerably more than India.

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<sup>16</sup> This section closely follows the discussion reported in Bhalla(2004c).

4. The country with the largest improvement in inequality is Tanzania. The consumption Gini improved by a large 44 (log) percent, from 59.5 in 1991 to 38.4 in 1993; the expenditure shares of the poor increased by 50 percent. With average expenditure growth of only 33 percent between 1980 and 2000, the inequality change allowed Tanzania to show large (above 80 percent) gains in real expenditures for the poor. Its pro-poor rank among all countries is 5<sup>th</sup>
5. Sub-Saharan Africa has four countries – Guinea, Tanzania, Uganda and Kenya in the top half of countries showing pro-poor growth. Both India and Pakistan are among the top ten – this ranking is not sensitive to the index used.

**Table 6: Growth, Poverty and Inequality, Developing world, 1980-2002**

Country	Region	Poverty line	<u>(log) Growth in expenditure (%)</u>			<u>Poverty decline (percentage points)</u>		<u>Change in Inequality</u>			
			NA	Survey	Poor	Actual	Adjusted	Gini	Share of bottom 20 percent	Share in expenditures of poor	Ratio of growth of poor to non-poor
China	EA	0.9	144.9	132.6	122.4	-42	-115.6	-31.8	-29.2	-22.5	0.8
Indonesia	EA	1.1	110.9	78.1	117.5	-57.4	-99.8	9.6	20.9	6.6	1.1
Guinea	SSA	2	61.5	61.5	83.9	-32.3	-73.8	15.7	75.8	22.4	1.6
Thailand	EA	2	79.5	73.2	73.9	-33.1	-73.6	-1.6	-12.2	-5.6	0.9
Tanzania	SSA	0.9	33	42.8	84.2	-31.3	-63.5	44	104.1	50.2	8.6
Vietnam	EA	2	58.3	58.3	52.6	-35	-57.1	-9.1	-18.2	-5.8	0.8
Uganda	SSA	1.7	47.1	35.7	60.7	-29.2	-55.9	17.4	37.1	13.6	1.6
Pakistan	SA	1.8	49.9	34.9	50.9	-37.2	-54.7	-0.5	3.4	1	1
India	SA	1.1	52.6	18.3	54.1	-36.2	-53.4	0	5	1.5	1
Israel	EMENA	6	41.1	19.3	41.1	-16.9	-49.3	0	0	0	1
Turkey	EMENA	4.6	36.2	9.7	40.2	-23.7	-43.1	4.9	-1.7	4	1.2
Sri Lanka	SA	1.7	45.8	33.6	40.2	-29.3	-42.7	-6.7	-7.8	-5.6	0.8
Lao	EA	1.5	47.3	47.3	40.3	-32.8	-40.9	-13.4	-12.7	-7	0.8
Malaysia	EA	1.8	39	-2.3	49.5	-12.9	-38.6	4	17.3	10.5	1.3
Bolivia	LAC	3.3	7.3	18.7	7.8	-11.1	-31.4	-5	-61.1	1.4	1.1
Brazil	LAC	2.3	4.7	-3.7	26.1	-8.4	-28.4	10.6	18.8	21.6	7.4
Tunisia	EMENA	2.6	30.5	41.9	31	-8.5	-21.6	1.9	0	0.4	1
Philippines	EA	3.4	22.2	49.4	31.2	-9.1	-21.1	9.4	46	9	1.7
Dominican Republic	LAC	2.8	28.5	37.6	22	-8.2	-20.3	-11.2	-5.7	-6.6	0.8
Egypt	EMENA	3.1	21.8	40.9	8	-10.9	-17.3	-20.6	-26.1	-13.8	0.3
Bangladesh	SA	1.1	31	17.3	16.6	-10.9	-14.2	-26.4	-12	-14.5	0.5
Mexico	LAC	3.3	4.2	-42.8	17.8	-5.5	-13	8	25.5	13.5	16.2
Kenya	SSA	1.5	-23.9	-8.2	14.4	-5.7	-12.9	25.7	38.6	38.2	-0.5
Cambodia	EA	2.1	24.8	-15.9	5.3	-9.1	-11.7	-17.6	-28.2	-19.5	0.2
Chile	LAC	3.6	40.8	42.1	10.8	-5	-11.5	-19.1	-23.5	-30	0.2

**Table 6: Growth, Poverty and Inequality, Developing world, 1980-2002 (continued)**

Country	Region	Poverty line	<u>(log) Growth in expenditure (%)</u>			<u>Poverty decline (percentage points)</u>		<u>Change in Inequality</u>			
			NA	Survey	Poor	Actual	Adjusted	Gini	Share of bottom 20 percent	Share in expenditures of poor	Ratio of growth of poor to non-poor
Hong Kong	EA	2.5	56.8	75.4	19.7	-2.5	-8.6	-26.5	-34.3	-37.1	0.3
Jordan	EMENA	2.9	-19.7	-18	7.3	-3.9	-7.8	20.6	27	27	-0.3
Colombia	LAC	6.3	3	17.6	-1.4	-1.6	-5.8	-3.8	-3.3	-4.3	-0.2
Senegal	SSA	1.7	2.4	-18	4.4	-1.1	-3.2	0.6	-12.1	2	3.2
Algeria	EMENA	3.5	-7.6	-19.3	-0.5	-0.1	-0.3	12.3	7.4	7.1	0.1
South Africa	SSA	4.5	0.1	0.1	0.1	0	-0.1	.	0	.	1
Morocco	EMENA	2.3	5.3	14.9	5.2	0.5	1.1	-2.3	-1.5	-0.7	1
Ecuador	LAC	3.9	-0.6	23.2	-1.6	0.7	2.7	0.1	20.5	-1	-1.3
Papua New Guinea	EA	1.8	-37.5	-37.5	-56.8	1.5	3.2	-42.2	-48.4	-17.9	-2.1
Honduras	LAC	2	-12.5	-5.5	0.8	1.2	3.3	5.6	.	13.3	-0.1
Guatemala	LAC	3	-7.2	14.9	-4.9	3.2	14.7	4	30.5	2.3	0.5
Burkina Faso	SSA	1.3	-14.1	-22.9	-14.6	6.7	16	-0.9	-1.8	-0.5	1.1
Ghana	SSA	1.2	-13.4	-7.8	-27.2	12.2	19.1	-11.5	-17.1	-13.7	2.6
Ethiopia	SSA	1.1	-8.6	17.3	-26.3	16.1	23.8	-21.3	-17.8	-17.6	3.4
Niger	SSA	1.3	-39.9	-16.3	-62.7	8.7	24.1	-33.6	-105.9	-22.8	2.9
El-Salvador	LAC	3.1	-25.1	-30.7	-27.2	9.7	24.9	-5.6	-30.1	-2.1	1.1
Zambia	SSA	0.9	-16.3	-35.2	-17.8	10.4	27.3	-7.3	-3	-1.7	1.1
Mali	SSA	1.2	8.3	-90.9	-32.7	13.2	28.2	-32.4	-42	-41	-3.3
Coted'Ivoire	SSA	2	-57.9	-71.8	-31.2	18.8	39.2	11.6	22	26.6	0.5
Madagascar	SSA	1.4	-47.9	-47.5	-46.7	15.5	55.2	1.7	7.7	1.3	1
Burundi	SSA	1.7	-88.9	-88.9	-88.9	34.2	80.6	.	0	.	1
Venezuela	LAC	2.8	-59.9	-99.7	-90.4	36.7	83.3	-24.8	-30.1	-30.1	1.5
Peru	LAC	3	-77.4	-77.4	-75.6	28.7	97.6	2	0	1.8	1
Nigeria	SSA	0.8	-89.5	-77.6	-119	51.9	101.1	-25.4	-31	-29.5	1.4
Paraguay	LAC	6.4	-12.4	21.3	-34.3	.	.	-37.4	-113.3	-20.8	-1.2

**Table 7: Ranks: Growth, Poverty and Inequality, Developing world, 1980-2002**

Country	Region	<u>(log) Growth in expenditure (%)</u>			<u>Poverty decline (percentage points)</u>		Gini	<u>Change in Inequality</u>		
		NA	Survey	Poor	Actual	Adjusted		Share of bottom 20 percent	Share in expenditures of poor	Ratio of growth of poor to non-poor
China	EA	1	1	1	2	1	44	40	42	32
Indonesia	EA	2	2	2	1	2	9	10	13	18
Guinea	SSA	4	5	4	8	3	5	2	5	10
Thailand	EA	3	4	5	6	4	25	32	31	29
Tanzania	SSA	16	9	3	9	5	1	1	1	2
Vietnam	EA	5	6	8	5	6	32	36	32	31
Uganda	SSA	10	14	6	11	7	4	5	7	9
Pakistan	SA	8	15	9	3	8	23	17	21	21
India	SA	7	21	7	4	9	22	16	18	20
Israel	EMENA	12	19	11	13	10	21	18	23	23
Turkey	EMENA	15	27	13	12	11	13	24	14	14
Sri Lanka	SA	11	16	14	10	12	30	29	30	30
Lao	EA	9	8	12	7	13	35	33	34	33
Malaysia	EA	14	29	10	14	14	15	13	10	13
Bolivia	LAC	24	20	25	15	15	28	47	19	15
Brazil	LAC	26	30	17	21	16	8	12	6	3
Tunisia	EMENA	18	11	16	20	17	17	21	22	22
Philippines	EA	21	7	15	19	18	10	3	11	8
Dominican Republic	LAC	19	13	18	22	19	33	28	33	34
Egypt	EMENA	22	12	24	16	20	38	38	36	39
Bangladesh	SA	17	23	21	17	21	42	30	37	37
Mexico	LAC	27	43	20	24	22	11	8	8	1
Kenya	SSA	41	33	22	23	23	2	4	2	46

**Table 7: Rankings in Growth, Poverty and Inequality, Developing world, 1980-2002 (continued)**

Country	Region	<u>(log) Growth in expenditure (%)</u>			<u>Poverty decline (percentage points)</u>		Gini	<u>Change in Inequality</u>		
		NA	Survey	Poor	Actual	Adjusted		Share of bottom 20 percent	Share in expenditure s of poor	Ratio of growth of poor to non-poor
Cambodia	EA	20	34	27	18	24	36	39	40	41
Chile	LAC	13	10	23	25	25	37	37	45	40
Hong Kong	EA	6	3	19	27	26	43	44	47	38
Jordan	EMENA	40	36	26	26	27	3	7	3	45
Colombia	LAC	28	22	33	28	28	27	27	29	44
Senegal	SSA	29	37	29	29	29	19	31	16	5
Algeria	EMENA	33	38	32	30	30	6	15	12	42
South Africa	SSA	30	28	31	31	31	.	19	.	25
Morocco	EMENA	25	26	28	32	32	26	23	25	27
Ecuador	LAC	31	17	34	33	33	20	11	26	48
Papua New Guinea	EA	43	42	45	35	34	48	46	39	49
Honduras	LAC	36	31	30	34	35	12	.	9	43
Guatemala	LAC	32	25	35	36	36	14	6	15	35
Burkina Faso	SSA	38	39	36	37	37	24	25	24	19
Ghana	SSA	37	32	39	41	38	34	34	35	7
Ethiopia	SSA	34	24	38	44	39	39	35	38	4
Niger	SSA	44	35	46	38	40	46	48	43	6
El-Salvador	LAC	42	40	40	39	41	29	41	28	17
Zambia	SSA	39	41	37	40	42	31	26	27	16
Mali	SSA	23	49	42	42	43	45	45	48	50
Coted'Ivoire	SSA	46	45	41	45	44	7	9	4	36
Madagascar	SSA	45	44	44	43	45	18	14	20	28
Burundi	SSA	49	48	48	47	46	.	20	.	24
Venezuela	LAC	47	50	49	48	47	40	42	46	11
Peru	LAC	48	46	47	46	48	16	22	17	26
Nigeria	SSA	50	47	50	49	49	41	43	44	12
Paraguay	LAC	35	18	43	.	.	47	49	41	47

**Table 8a Correlations: levels of Growth, Poverty and Inequality, developing world, 1980-2002**

	Growth in expenditure			Poverty decline		Inequality Change			
	NA	Survey	Poor	Actual	Adjusted	Gini	Bottom 20 %	Share of exp (poor)	Poor/non-poor (growth)
Growth in exp(NA)	1								
Growth in exp (Survey)	0.87	1							
Growth in exp (Poor)	0.93	0.83	1						
Poverty, Actual	-0.90	-0.80	-0.94	1					
Poverty, estimated	-0.92	-0.84	-0.96	0.97	1				
Gini	0.05	0.09	0.40	-0.29	-0.27	1			
Bottom 20 %	0.16	0.18	0.45	-0.31	-0.29	0.85	1		
Share of exp (poor)	0.00	0.07	0.38	-0.30	-0.29	0.93	0.80	1	
Poor/non-poor (growth)	0.00	-0.03	0.14	-0.06	-0.09	0.34	0.31	0.36	1

**Table 8b Correlations: - Ranks of Growth, Poverty and Inequality, 1980-2002**

	Growth in expenditure			Poverty decline		Inequality Change			
	NA	Survey	Poor	Actual	Adjusted	Gini	Share, Bottom 20 %	Share in exp (poor)	Poor/non-poor (growth)
Growth in exp(NA)	1								
Growth in exp (Survey)	0.84	1							
Growth in exp (Poor)	0.91	0.81	1						
Poverty, Actual	0.89	0.78	0.95	1					
Poverty, estimated	0.89	0.80	0.97	0.98	1				
Gini	0.04	0.05	0.35	0.23	0.29	1			
Bottom 20 %	0.10	0.13	0.38	0.24	0.29	0.91	1		
Share of exp (poor)	0.01	0.00	0.34	0.25	0.30	0.96	0.88	1	
Poor/non-poor (growth)	0.00	-0.02	0.14	0.04	0.11	0.22	0.15	0.27	1

### Notes for Tables 6,7 and 8:

1. The region abbreviations are as follows: - EA – East Asia, EMENA – Middle East and North Africa, LAC – Latin America, SA – South Africa and SSA – Sub Saharan Africa.
2. The poverty line is country specific and defined in per capita per day terms, 1993 consumption PPP prices.
3. *Expenditure growth*: NA and Survey data refer to (log) growth rates as derived from national accounts and household survey data. “Poor” refers to the fraction of the poor observed for each country in 1980; this fraction is kept constant in consumptions involving growth in their expenditure.
4. *Poverty*: Actual and Adjusted. These columns report the arithmetic change in the head count ratio 1980-2002. The “adjusted” decline column reports the actual change divided by the average “Shape of distribution” elasticity observed during 1980-2002.
5. *Inequality*: (log) change in the expenditure share of the poor – the poor are defined above; share refers to the share of the poor in total expenditure; Ratio of poor to non poor growth is the ratio of the growth experienced by the poor in 1980-2002 to the growth experienced by the non-poor.
6. The sign for inequality change (Gini) has been reversed i.e. an increase in inequality results in a negative value for the (log) change in the Gini.

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