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IMPROVEMENTS IN CHILDREN'S HEALTH: DOES INEQUALITY MATTER?

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Abstract: The literature on the contributions to poverty reduction of average improvements in living standards vs. distributional changes uses only one measure of well-being -- income or expenditure. Given that poverty is defined by deprivation over different dimensions, we explore the role of average improvements and distributional changes in children's health and nutrition using the height of young children as our measure of well-being. Similar to the income literature, we find that shifts in the mean level of heights, not changes in distribution, account for most improvements in heights. Unlike the literature on income inequality, however, there is a positive association between improvements in average heights and reduced dispersion of those heights.

1. INTRODUCTION

There is a large literature that examines the relationship between growth, inequality, and poverty. While it is clear that distributionally neutral economic growth unambiguously reduces most poverty measures, economists have long recognized the possibility that improvements in average incomes could be accompanied by a worsening of the income distribution (Kuznets, 1955), and that this could be sufficient to increase poverty despite the economic growth. Considerable effort has gone into testing whether or not increases in average incomes are accompanied by worsening income distributions (Saith 1983; Anand and Kanbur 1993; Lecallion et al. 1983; Ravallion and Chen 1995) and, more recently, on testing the relative contributions of growth and redistribution to poverty changes (Fields 1989; Squire 1993; Ravallion 1995; Bruno et al. 2000). This is a particularly important question since it underlies much of the debate on whether a policy focus on economic growth alone is sufficient to reduce poverty. Many detractors of structural adjustment programs, for example, have argued that the while they may contribute to economic growth, they have an adverse affect on the poor (Cornia et al. 1987; Mkandawire and Soludo 1999; Forsythe et al. 2000). Most of the empirical evidence suggests, however, that growth does reduce poverty (Sahn et al. 1997; Dollar and Kraay 2002), but it is also clear that the income distribution affects the extent to which a given amount of growth reduces poverty (Ravallion 1995; Chen and Ravallion 2000; World Bank 2000).

In order to flesh out the relative importance of income growth and redistribution on poverty, considerable efforts have been made to develop methods for, and undertake empirical studies of, the decomposition of poverty change into growth and distribution components. The growth-redistribution literature has frequently involved attempts to decompose the observed changes in poverty into the impact of growth, assuming that the income distribution remains the same over time, and the impact of redistribution of income, assuming that the mean level of income remains constant over time.

All of the literature on the contributions to poverty reduction of average improvements in living standards vs. distributional changes uses only one measure of well-being, income or expenditure. Yet at a conceptual level, most economists accept Sen's argument that poverty is multidimensional – the deprivation of a variety of basic capabilities or failure of basic functionings – not just low levels of income (Sen, 1979, 1985, 1987; Dreze and Sen 1989). In light of these ideas, exploring how average improvements and distributional changes in other measures of well-being is an important addition to the existing growth/redistribution literate. This paper does just that, using the height of young children as our measure of well-being.

We view this work as a complement to, not a substitute for, the existing income-based literature. We also recognize that there are many other possible measures of health, to say nothing of well-being. But children's height has attractive characteristics, which we discuss in detail in section 2. Section 3 gives a brief presentation of the standard decomposition methods from the income poverty literature, following Datt and Ravallion (1992) and Kakwani (1997). We also discuss the Demographic and Health

Survey data that we employ in our empirical analysis. Our coverage is quite broad, including decompositions for 43 "spells" – periods over which we have two surveys to compare – from 29 developing countries. Section 4 presents the results. In addition to decompositions of "height poverty",[1] we examine the correlation between the growth and redistribution components of height poverty changes. We conclude with an assessment of the implications of these findings, including a comparison of our results with the existing literature on income decompositions.

2. CHILD HEIGHT AS A MEASURE OF WELL-BEING

The most important reason to use the height of pre-school age children for our analysis of health distributions is the abundance of medical and public health research showing that children's height is a good, objective indicator of their general health status, providing us with an observable measure of one of Sen's basic functionings (Cole and Parkin 1977; Mata 1978; Tanner 1981; Mosley and Chen 1984; WHO 1995). The principle determinants of the distribution of children's height in a population are the accumulation of episodes of inadequate nutrient intake, disease, and deprivation that result in stunted growth (Scrimshaw et al. 1968; Martorell et al. 1975). Thus, a good measure of the extent of children's health deprivation is the deviation of the distribution of heights in a population from the distribution for a reference population of healthy children who reach their genetic potential (WHO 1983; Beaton et al. 1990; WHO 1995).

On the strength of this evidence, the most prominent economic literature modeling health status in developing countries uses children's height as its dependent variable (Strauss and Thomas 1995; Behrman and Deololikar 1988). Most analyses of children's height, including ours, are limited to young children because the distributions of heights of healthy children among populations are strictly comparable regardless of racial and ethnic composition, as pointed out by the seminal work of Habicht et al (1974). This notion that the distribution of healthy children's heights is the same for different ethnic and racial groups is counter-intuitive for many people – surely Masai children are taller than Pygmie children – but that intuition comes from casual observation of adults, or perhaps malnourished children. Such differences are not observed among healthy children under the age of five, a proposition that has gained widespread support in physical anthropology and the biomedical sciences (Graitcher and Gentry 1981; WHO 1983; Martorell and Habicht 1986; Ulijaszek 2001; Bustos et al. 2001).

Children's height also fits several important requirements for a well-behaved poverty measure. The standard measure of inadequate nutrition, stunting (an excessively low height conditional on age and gender), is a function of the share of observations below a given threshold, just like the income poverty headcount. We can interpret this threshold as a "height poverty line." Any movement in the lower end of the height

[1] While we have sometimes referred to inadequate stature as "health poverty" and at other as "nutrition poverty," neither is completely satisfactory. On one hand, there is much more health then adequate stature. On the other, inadequate growth is usually caused by disease as well as inadequate nutrition.

distribution to the right will show a reduction in stunting, which we will interpret as "height poverty." Children's heights also satisfy the requirement that a good poverty measure should be a non-increasing function of distributionally neutral growth.

A more challenging question is whether height inequality is a meaningful concept. Two distinct objections could be raised. First, the early nutrition literature on anthropometry suggested that the dispersions of standardized height distributions are (almost) the same in all samples, with only the means varying significantly from one sample to another (Martorell and Habicht, 1986). If this were the case, then height inequality would be virtually the same in every sample, and there would be no point to studying it. However, as our results here and elsewhere[2] show, the dispersions of height distributions do differ across places and across time. As a result, stunting rates can vary not only because means vary, but also because higher moments are different. Thus, it is meaningful to examine the extent to which differences in height poverty are due to differences in means vs. differences in distributions around those means. Pradhan, Sahn, and Younger (2003) develop an approach to measure and interpret height inequality that is analogous to the income inequality literature. [3] Here, we use standard techniques to decompose precisely the differences in two height distributions to "growth" and "redistribution" components: the growth component represents the simple shift in the mean, while the distribution component captures the effect of changing dispersion of heights.

A second objection stems from the fact that the study of income distributions is often closely linked to the public policy question of *re*distribution of income. Yet it is not possible to redistribute the heights of an existing population among its members in the same way that we can redistribute income. Nevertheless, differences in height poverty, driven by either mean height or height inequality, can be related to public policy choices. The impact of public policy on mean heights is obvious. For inequality, suppose, that a government decides to reduce spending on curative health care for (relatively well-off) urban residents and to invest those resources in preventative public health measures in (relatively poorer) rural areas. The result of such a policy would tend to compress the height distribution -- reduce height inequality -- by raising the heights of a relatively short population and lowering those of a relatively tall one. It is possible that this occurs while leaving the overall mean of heights unchanged. In such a case, overall height poverty would decline only because the distribution of heights improved. Of course, this does not happen by *re*distributing heights of existing children, but rather by changing the distribution for a new cohort, making it more equal.

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[2] Pradhan, Sahn, and Younger, 2003.
[3] This approach is to be distinguished from of the literature on health inequality that explores how health differs across various socio-economic dimensions. The positive correlation, or "gradient," between health and socioeconomic status has led researchers to focus on income-related inequalities in health status and access, or on the importance of relative income or social position as a determinant of health (e.g., Wagstaff et al. 1991; Contoyannis and Forster 1999; Preston and Taubman 1994; van Doorslaer et al. 1997).

There are a number of other advantages to using children's heights to make welfare comparisons. First, unlike income, expenditure, or assets, nutritional status is observable for individuals rather than households. We do not have to suppose that all household members have the same level of well-being. Second, inaccurate price deflators can limit the reliability of inter-temporal income comparisons, while heights are strictly and easily comparable across time. Third, measurement of height is straightforward, and not subject to the errors in income or expenditure measurement that result from misreporting, differences in questionnaire design, recall periods, and even the nature of interviewer training (Bhalla and Glewwe 1986; Pradhan 2000; Scott and Amenuvegbe 1990; Demery and Mehra 1996; Deaton and Grosh 2000). To the extent that any of these errors is correlated with income itself, poverty decompositions will be biased.

3. METHODS

The most widely used decomposition method is the one proposed by Datt and Ravallion (1992). The components of the total change in poverty can be captured using a class of poverty measures that are fully characterized by the poverty line (*z*), the mean of the distribution (μ), and the Lorenz curve (*L*). For date *t* the poverty measure can be written as

$$P_t = P\left(z, \mu_t, L_t\right). \tag{1}$$

A change in poverty between period *t* and *t+n* can then be decomposed as follows:

$$P_{t+n} - P_t = \underbrace{G(t, t+n; r)}_{\text{growth component}} + \underbrace{D(t, t+n; r)}_{\text{redistribution component}} + \underbrace{R(t, t+n; r)}_{\text{residual}} \tag{2}$$

growth component, *G()*, is defined as the change in poverty due to a change in the mean of the distribution, holding the Lorenz curve constant at that of the reference year *r*:

$$G(t, t+n; r) \equiv P(z, \mu_{t+n}, L_r) - P(z, \mu_t, L_r). \tag{3}$$

Similarly, the redistribution component, *D()*, is defined as the change in the Lorenz curve while keeping the mean of the distribution constant at that of the reference year *r*:

$$D(t, t+n; r) \equiv P(z, \mu_r, L_{t+n}) - P(z, \mu_r, L_t) . \qquad (4)$$

As Datt and Ravallion (1992) point out, the residual *R( )* is present whenever a change in the poverty measure due to changes in the mean (distribution) also depends on the precise distribution (mean) (i.e. when the poverty measure is not additively separable in μ and *L*).

Datt and Ravallion point out that the growth and distribution components will differ depending on which reference period is used, a choice that is arbitrary. Kakwani (1997) has argued that such arbitrariness is undesirable, and that the only way to avoid it is to make the calculation using first one period then the other as the reference period, averaging the results. As Datt and Ravallion noted, this procedure also eliminates the residual, which is difficult to interpret. This practice has been adopted widely in the recent literature, and we follow it here (McCulloch et al 2000; Dhongde 2002; Shorrocks and Kolenikov 2001; Christiaensen et al. 2002).

Analyses of children's heights are usually carried out based on a child's z-score, the number of standard deviations that a child is above/below the median of the distribution of healthy children. The limiting distribution of the z-score is standard normal, so a child who is below –2 z-scores has only a very low probability (about) of being of normal height. Thus, the World Health Organization (1983) takes –2 z-scores to be the height poverty line, below which a child is judged to be stunted (height poor).

z-scores can be negative, and typically are for many poor children, yet most distributional statistics require measures of well-being to be positive. Thus, rather than use z-scores, our analysis uses "standardized heights." Each child's height is transformed to the height for a reference age and gender, which in our case, is girls at 24 months of age. The standardized height measure is constructed such that a child's position in the distribution, in terms of percentiles, is the same for actual height in the actual age/sex group and the transformed height in the reference group WHO distribution. More specifically,

$$H = F^{-1}_{\bar{a},\bar{g}}(F_{a,g}(h)) \qquad (5)$$

where *F* is the distribution function of heights in the WHO population for an age/sex group defined by a (age) and g (gender); *h* is the actual height; $\bar{a}$ = 24 months; $\bar{g}$ = female; and H is standardized height. Our choice of 24-month-old females for the standardization is arbitrary. We could have selected, for example 10-month-old boys. Our results, however, are not sensitive to the choice of age/gender for standardization.

To illustrate the application of the growth-redistribution decomposition to these standardized heights, Figure 1 shows the –2 z-score cut-off point based on the reference population. This represents the height poverty line, and we can make a standard probability argument that if a child's height falls below this level, it is probable that he or she suffers from stunting and poor health. We show two curves, marked A and B in the figure. Assuming this stylized example represents a country at two points in time, we have a substantial share of the population that is malnourished in both periods. However, the share of persons malnourished increases from time A to B. In this case, it is due to both changes in the distribution (which is more skewed to the left), and changes in the mean (which has also shifted to the left). It is precisely the contribution of those two changes to the overall increase in the area to the left of the poverty line that we decompose. We do this both for the traditional stunting measure, analogous to the poverty headcount, and, following the work of Sahn and Stifel (2002), also for other members of the Foster-Greer-Thorbecke type poverty measures. This class of measures can be written as:

$$M_\alpha = \tfrac{1}{N}\sum_{i=1}^{N}(z - y_i)^\alpha I(y_i \le z), \qquad (6)$$

where y_i is an independent observation of our welfare indicator (standardized height) from a sample of size *N*; *z* is the poverty line, equal to the 2.27th percentile of the cumulative distribution (approximately equal to -2 z-scores); and $I(\cdot)$ is an indicator function that takes a value of one if its argument is true, and zero otherwise.[4] When α is 0, 1 and 2, we have, respectively: stunting, the *prevalence* of height poverty, or the percentage of the population who are malnourished; a height *gap* index, or the mean distance below the poverty line for those that are stunted; and the stunting *severity* index (or the squared height gap) defined as the mean squared height gap.[5]

[4] The FGT measure is typically defined as, $P_\alpha = \tfrac{1}{N}\sum_{i=1}^{N}\left(\frac{z - y_i}{z}\right)^\alpha I(y_i \le z)$, where the individual's poverty gap is expressed as a proportion of the poverty line. This creates a unit free measure that is comparable across populations. The measure we present in the text does not follow this convention because (a) the heights that we use are already standardized across populations, and (b) the absolute gap (i.e. z-y_i) has a meaningful interpretation – it is the number of standard deviations that a child's z-score falls below the poverty line.

[5] In the results section we do not present the severity index because the magnitude of changes is so small that the decomposition is of little interest.

4. DATA

The data used in this study are from Demographic and Health Surveys (DHS). DHS has conducted over 80 nationally representative household surveys in more than 50 countries since 1984. While the designs of the surveys are not entirely uniform, efforts are made to standardize them so that in most cases they are comparable. The DHS program is designed for typical self-weighted national samples of 5,000 to 6,000 women between the age of 15 and 49. In some cases the sample sizes are considerably larger, and some areas are over/under sampled.[6] For all of the countries in this study, except Uganda, the surveys are nationally representative.[7]

Because we want to decompose changes in height poverty, we are limited to countries with available cross-sectional surveys for two or more years. This gives us a total of 43 spells – cases where we have data for two periods of time – in 29 countries. Of those, 17 are from countries in sub-Saharan Africa.

5. RESULTS

Table 1 presents the results of the decompositions for the height poverty headcount (stunting rate). We find that the contribution of change in the average height of the population to the overall change in the height poverty headcount is generally far greater in absolute value than the redistribution component, especially when the total change is of a non-trivial magnitude. For example, in the case of Ghana between 1993 and 1998, the positive change in the mean of the Kakwani decomposition is nearly four times larger than the absolute value of the redistribution component, which is negative. In the case of Namibia, where the share of malnourished children declines from 28.5 to 22.6 percent, the growth component was 6.15 versus 0.32 for the redistribution component. And in Togo, which witnessed a decline in P_0 from 29.2 to 21.7, the change due to a shift in the mean was more than 16 times greater in magnitude than the redistribution component. Overall, the magnitude of the growth component is three or more times greater than the redistribution component for 22 of the 43 spells studied. In several cases, the former is ten times greater. Thus, distribution neutral increases in the average heights of children play a much more important role for changes in stunting than do changes in the distribution. In all but two of the 19 cases where stunting declines by more than five percent, the improvements are driven by the increase in the mean. For example, out of the 19 percent decline in stunting in Brazil between 1986 and 1996, 17. 6 percent was attributable to movements in the mean; and of the 10.0 percent decline in Bangladesh between 1986 and 2000, 9.2 percent was likewise due to a shift of the distribution to the right. As an example, Figure 2 shows kernel estimates of the

[6] For example, the Tanzanian DHS data for 1991 and 1996 both have sample of about 8,000 women.
[7] In the analyses that follow for Uganda only those regions included in all three DHS surveys are included. (Some areas were not surveyed due to civil conflict).

probability densities for standardized height in Brazil. While the 1996 distribution is somewhat less dispersed that the 1986 distribution, this difference is minor compared to the large rightward shift in the mean.

While the component that captures the change in the mean is clearly more important, redistribution does matter for a couple of the countries. This is especially so for the three cases with a worsening of the headcount. In Cameroon and Zimbabwe from 1994 to 1999, the change in the redistribution component is larger in absolute magnitude than the growth component and drives the observed deterioration in the headcount. In Nigeria between 1990 and 1999, the worsening of the headcount is due in equal share to the contribution of a shift in the mean, holding the height Lorenz curve constant, and the contribution of the redistribution component. As an example, Figure 3 shows estimated probability density functions for standardized heights in Cameroon in 1991 and 1998. Here the small decline in mean heights is difficult to discern, but the 1998 distribution is clearly more unequal.

We also examine the relationship between the growth and redistribution component for the 43 spells in our data. The correlation coefficient between the two components is 0.36, and is significant at the 1 percent level. Thus, there is evidence that more rapid improvement in the average height of children is accompanied by a decrease in height inequality; and conversely, there is an association between declining mean heights and worsening distribution of heights. It is nevertheless noteworthy that the signs of the growth and distribution component sometimes differ, implying offsetting effects of redistribution and growth. In many instances, however, such as Tanzania between 1991 and 1996, these opposite-signed effects are both of trivial magnitude; while in other cases, such as Niger, the overall contribution of the opposite signed redistribution effect is of such a small magnitude (-0.44) compared to the growth effect of 5.18, that it is of little relevance. Nonetheless, there are a couple of cases where the redistribution component offsets the benefit of the shift in the mean. For example, there was virtually no change in the share of children who are malnourished in Kenya between 1993 and 1998 even though mean heights improved. Figure 4 shows that the mean of the 1998 distribution is higher, but so is its dispersion. If there had not been a worsening in the distribution of height outcomes between the two periods, the increasing average heights of the population would have contributed to a decrease in the malnutrition headcount index from 33.2 to 30.2 percent of the pre-school age population.

How do these results compare to similar decompositions conducted on income changes? We have reviewed a series of studies. The decomposition results are in fact quite similar to what we find for our height decompositions. For example, in Brazil, among the five spells for which data are available, the growth component is far more important in three; and in only one case is the redistribution component larger, although that is for a spell where the changes were quite small in magnitude (Datt and Ravallion 1992). The same authors also conduct decompositions in rural and urban India over several spells. All the major changes in income poverty that occur are primarily due to the impact of the growth effect, not redistribution.

In Ethiopia, Bigsten et al (2003) observe that the decline in poverty between 1994 and 1997 is attributable to the effect of the shift in the mean, which has a magnitude twice that of the offsetting distribution component. In five spells of poverty changes in Ukraine, and in four spells in Thailand, Kakwani finds that the growth effect far outweighs the importance of the redistribution component. The study by Balisacan (2000) also finds that the growth component drives the changes in the poverty numbers in the Philippines. In only one of four spells studied is the redistribution component of a larger absolute value, and like the case of Brazil, in this instance the overall magnitude of the changes is small relative to the other spells.

The positive correlation of the growth and distribution components that we observe for children's heights is, however, different from the bulk of the income poverty decomposition literature. For example, Ravallion and Chen's (1995) examination of 64 spells of change in expenditure and income distribution in 67 countries using 109 surveys leads them to conclude that higher growth is not associated with either improving or worsening distributional outcomes. Another recent study of five African countries by Christiaensen, Demery and Paternostro (2002) also finds that changes in poverty incidence are driven largely by changes in mean expenditures, but that these changes are not obviously correlated with the distributional component, which sometimes complements and sometimes works against the change in mean incomes.

Both of our key findings – that the change in the mean level of children's heights drives improvements in the height poverty headcount, and that improvements in mean heights are positively correlated with improvements in the distribution of heights – apply to the height gap measure as well (Table 2). In fact, in all but 3 of the 43 spells, the signs on the direction of the change in the P_0 and the $P_{1,}$ as well as the signs of the contribution of the growth and redistribution component, are the same. Those few spells, such as Cameroon and Zimbabwe between 1994 and 1999, that witness a relatively large deterioration in heights due to the adverse movement of the redistribution component according to the headcount measure, likewise see a similar pattern with the P_1 numbers. There are some cases where the relative importance of the growth and redistribution are different using the P_1 rather than P_0 index. For example, in Bangladesh the redistribution component represents nearly one-third of the overall improvement in the P_1 measure, but less than ten percent of P_0. However, most differences are cases where the changes themselves are very small. For example, in Zambia, there is decline in the percent malnourished by 2.5 percent, of which two thirds was a result of the shift in the mean. But for the decline in the heights gap measure, approximately two thirds was accounted for by the redistribution component. However, given the very small magnitudes of these changes, the differences in the relative contribution of growth and redistribution to headcount and gap measures are of little practical meaning. Finally, as with the P_0 index, we find a positive and statistically significant correlation, 0.54, between the growth and redistribution component of the height gap index.

5. CONCLUSIONS

In this paper we show that inter-temporal changes in children's height, like income and expenditures, can be decomposed into a growth and redistribution component. We conduct this exercise for 43 spells, using data from 29 countries. We do not observe any cases where a substantial improvement in the mean levels of height is accompanied by sufficiently large and negative changes in relative inequality to bring about a worsening of height poverty measures. Overall, the evidence is compelling that when the average height of children in a country improves, the heights of stunted children improve as well. This result is similar to existing results for changes in income poverty. But, unlike the literature on income inequality that suggests at best a neutral relationship between the growth and redistribution components, we find a positive association between average improvements in children's heights and the distribution of those heights.

Our analysis is purely descriptive, so it is difficult to draw lessons for policy from it. Nevertheless, the fact that it is the change in average heights that drives reductions in stunting in a wide variety of countries with very different stunting rates suggests that policies that aim to improve the overall health status of children will successfully lower height poverty. One reason that we can be emphatic about this conclusion lies in the nature of the distribution of children's heights. Unlike income or expenditure, there is a natural upper bound on heights. It is impossible to raise the mean height of a population of children by greatly increasing the heights of the already tall. Thus, efforts to raise mean heights must focus on those who have not achieved their growth potential. This alleviates the concern found in the income literature that rapid growth that is driven by increases in the incomes of the already rich may generate political problems that, in turn, stifle future growth (Persson and Tabellini 1994; Alesina and Rodrik 1994; Barro 1999; Ravallion 2001).

We recognize, however, that we have only explored one dimension of health, to say nothing of other dimensions of well-being. It is possible that other measures of health and well-being may result in different findings. In addition, we have conducted the decompositions of height, like income, across a single dimension of well-being, ignoring changes in all others, including incomes. An interesting problem is to think about multi-dimensional poverty decompositions analogous to the recent research on multi-dimensional poverty comparisons (Bourguignon and Chakravarty 1998; Duclos, Sahn and Younger 2003; Crawford 1999). This would involve careful consideration of how to address the aggregation problem across multiple indicators of poverty, rather than decomposing changes for each indicator independently of the others.

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Figure 1. Example of Changes in Mean and Redistribution in Heights

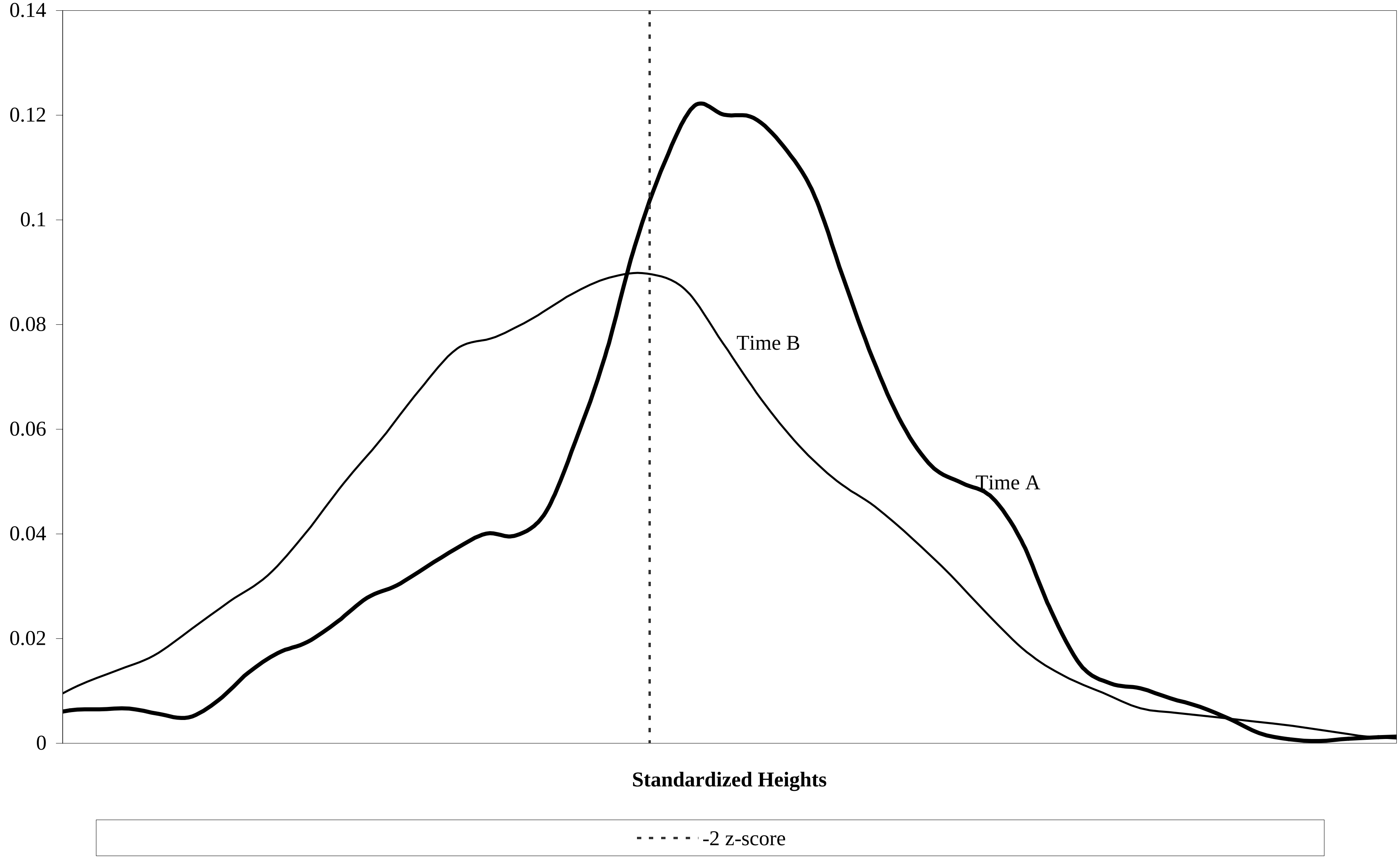

Figure 2. Changes in Mean and Re-distribution of Heights in Kenya

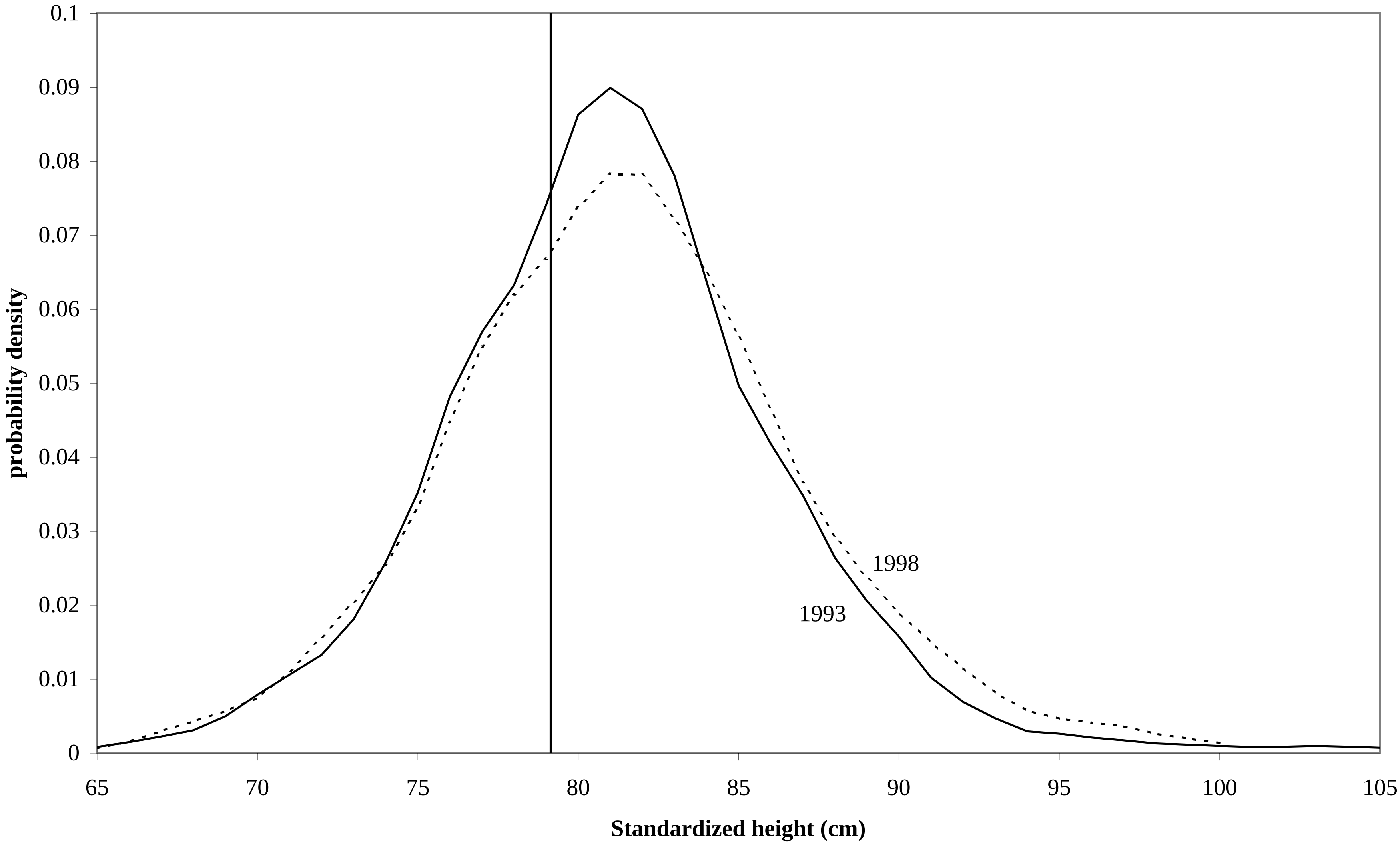

Figure 3. Changes in Mean and Re-distribution of Heights in Cameroon

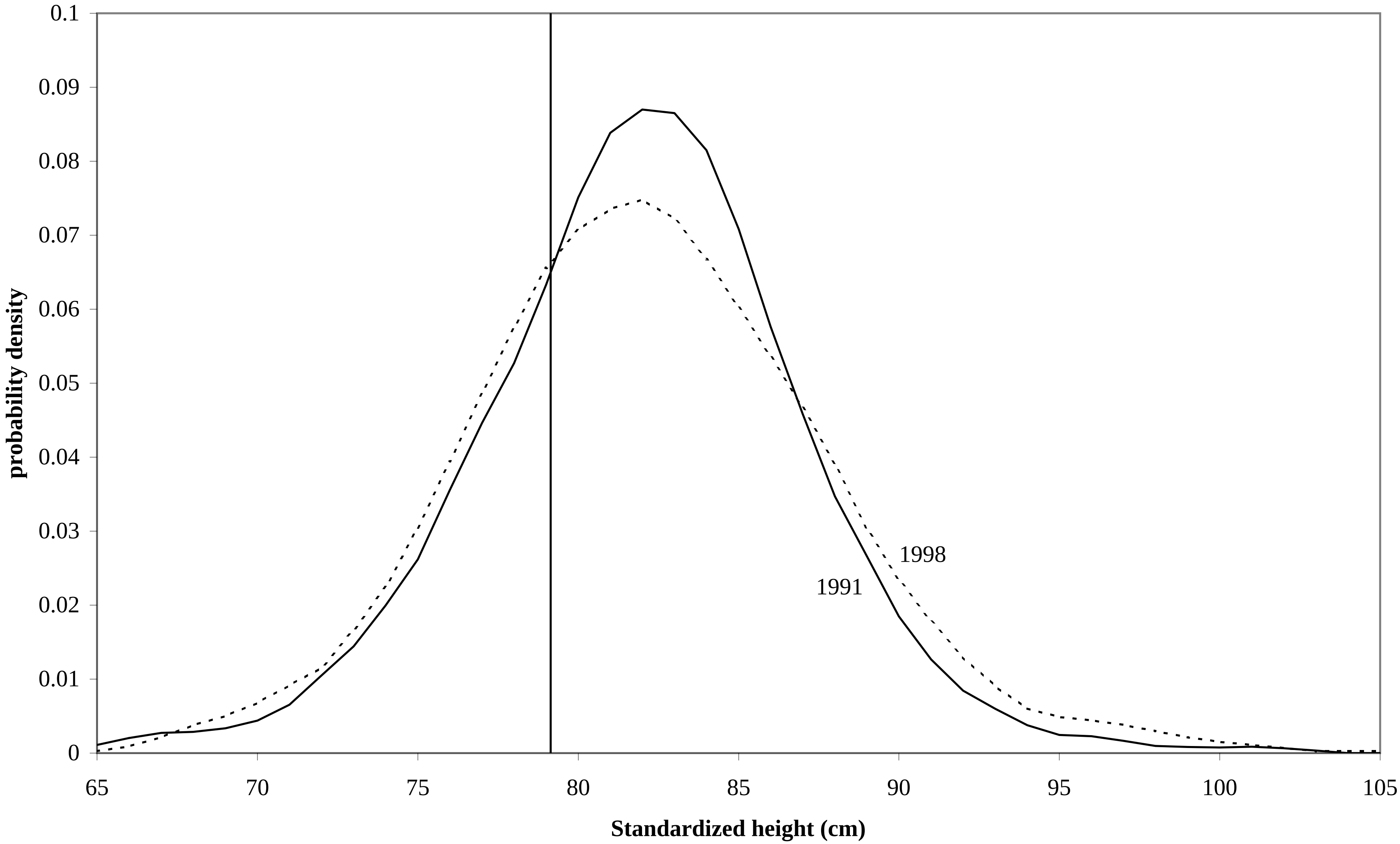

Figure 4. Changes in Mean and Re-distribution of Heights in Brazil

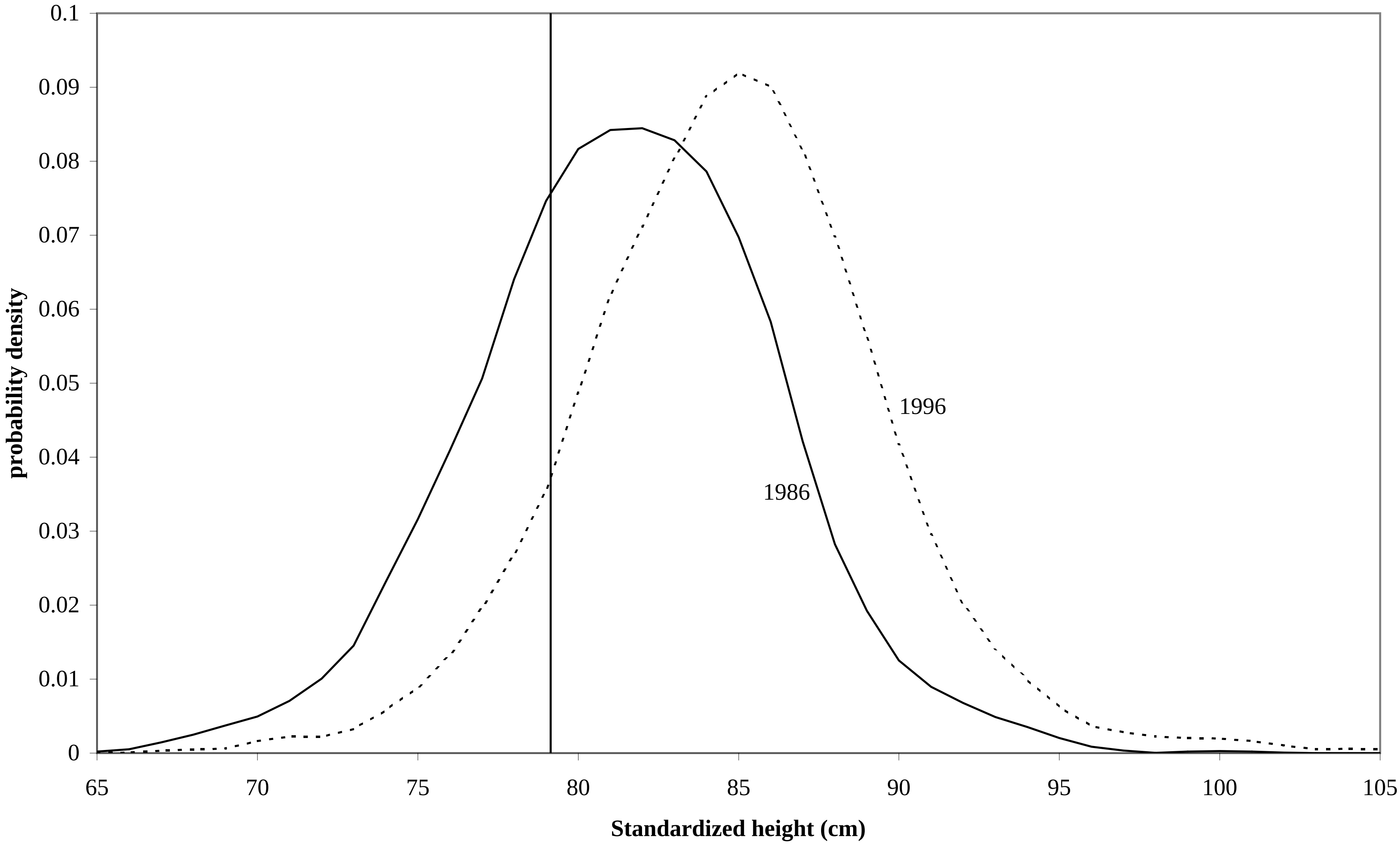

TABLE 1. Growth and Redistribution Decomposition of Height Headcount Index of Health Status.

Country (DHS years)	Height Headcount Index			Ravallion-Datt			Kakwani	
	First Survey	Last Survey	Change	Growth	Redistribution	Residual	Growth	Redistribution
Bangladesh (1996, 2000)	54.632	44.647	-9.985	-9.725	-1.304	1.045	-9.203	-0.782
Benin (1996, 2001)	24.979	27.074	2.095	0.135	0.135	0.563	1.6786	0.4164
Bolivia (1989, 1994)	37.691	28.169	-9.522	-8.637	0.572	-1.456	-9.3652	-0.1563
Bolivia (1994, 1997)	28.169	25.564	-2.605	-2.909	-0.396	0.699	-2.5593	-0.0462
Brazil (1986, 1996)	29.417	10.461	-18.956	-17.864	-1.632	0.540	-17.5941	-1.3618
Burkina Faso (1992, 1999)	33.309	36.809	3.500	4.053	-1.483	-0.930	4.5179	-1.0180
Cameroon (1991, 1998)	22.855	29.292	6.437	2.040	4.462	-0.065	2.0074	4.4295
Colombia (1986, 1995)	25.473	13.263	-12.163	-9.868	-3.800	1.505	-9.1155	-3.0476
Colombia (1995, 2000)	13.263	13.773	0.510	-0.052	0.510	0.052	-0.0258	0.5357
Cote d'Ivoire (1994, 1998)	24.442	21.921	-2.520	-2.747	-0.049	0.275	-2.6095	0.0885
Dominican Republic (1986, 1991)	20.691	18.182	-2.509	0.000	-2.623	-0.114	0.0570	-2.5660
Dominican Republic (1991, 1996)	18.182	12.031	-6.152	-5.227	-8.967	-0.028	-5.2408	-0.9110
Dominican Republic (1996, 2002)	12.031	9.776	-2.254	-1.785	-0.626	0.157	-1.7064	-0.5477
Ghana (1988, 1993)	29.929	27.521	-2.408	-3.380	0.416	0.556	-3.1019	0.6940
Ghana (1993, 1998)	27.521	21.168	-6.352	-4.694	-1.014	-0.644	-5.0158	-1.3361
Ghana (1998, 2003)	21.168	28.344	7.176	5.408	2.482	-0.715	5.0511	2.1240
Guatemala (1987, 1995)	57.783	48.778	-9.005	-8.235	-0.706	0.065	-8.2670	-0.7380
Guatemala (1995, 1999)	48.778	43.228	-5.550	-5.814	-1.256	1.519	-5.0341	-0.4960
India (1993, 1999)	47.126	44.937	-0.219	-1.747	-0.967	0.525	-1.4848	-0.7046
Kazakhstan (1995, 1999)	15.785	9.453	-6.331	-0.505	-5.726	-0.100	-0.5549	-5.7769
Kenya (1993, 1998)	33.249	33.023	-0.226	-2.964	2.802	-0.065	-2.9959	2.7695
Kenya (1998, 2003)	33.023	30.558	-2.464	-0.946	-1.652	0.133	-0.8793	-1.5850
Madagascar (1992, 1997)	49.179	48.340	-0.839	-1.916	0.940	0.136	-1.8474	1.0084
Malawi (1992, 2000)	49.220	49.024	-0.195	-2.009	1.135	0.678	-1.6697	1.4746
Mali (1987, 1995)	23.842	32.757	8.914	5.017	3.414	0.483	5.2588	3.6554
Morocco (1987, 1992)	28.539	24.206	-4.333	-3.641	-1.407	0.715	-3.2837	-1.0497
Namibia (1992, 2000)	28.478	22.644	-5.833	-5.871	0.600	-0.562	-6.1523	0.3187
Nepal (1996, 2001)	48.354	42.743	-5.611	-5.036	-0.297	-0.278	-5.1752	-0.4359
Niger (1992, 1997)	35.474	41.069	5.595	5.424	-0.942	1.113	5.9804	-0.3851
Nigeria (1990, 1999)	36.155	45.463	9.309	3.921	4.435	0.952	4.3971	4.9111
Nigeria (1999, 2003)	45.463	35.764	-9.698	-6.352	-3.363	0.018	-6.3436	-3.3546
Peru (1992, 1996)	31.797	25.765	-6.032	-5.692	-0.694	0.354	-5.5150	-0.5170
Peru (1996, 2000)	25.765	25.418	-0.346	0.533	-1.020	0.141	0.6031	-0.9495

TABLE 1. Growth and Redistribution Decomposition of Height Headcount Index of Health Status.

Senegal (1986, 1992)	23.162	25.800	2.637	0.143	2.158	0.336	0.3113	2.3260
Tanzania (1991, 1996)	43.422	43.430	0.213	-0.289	0.213	0.289	-0.1447	0.3578
Tanzania (1996, 1999)	43.430	42.557	-0.873	0.133	-1.489	0.484	0.3745	-1.2472
Togo (1988, 1998)	29.209	21.721	-7.488	-7.372	-0.607	0.491	-7.1268	-0.3611
Uganda (1988, 1995)	42.958	38.330	-4.628	-4.454	-0.843	0.669	-4.1192	-0.5090
Uganda (1995, 2000)	38.330	37.467	-0.862	-0.230	-0.862	0.230	-0.115	-0.747
Zambia (1992, 1996)	39.830	42.352	2.522	1.410	0.816	-0.296	1.5581	0.9638
Zambia (1996, 2001)	42.352	46.801	4.448	2.988	-0.073	1.533	3.7548	0.6939
Zimbabwe (1988, 1994)	29.812	23.278	-6.534	-8.718	0.819	1.365	-8.0350	1.5012
Zimbabwe (1994, 1999)	23.786	28.508	5.229	-0.490	5.229	0.490	-0.2452	5.4742

TABLE 2. Growth and Redistribution Decomposition of the Height Gap Index of Health Status

	Height Gap Index			Ravallion-Datt			Kakwani	
Country (DHS years)	First Survey	Last Survey	Change	Growth	Redistribution	Residual	Growth	Redistribution
Bangladesh (1996, 2000)	2.979	2.016	-0.963	-0.647	-0.307	-0.009	-0.652	-0.3113
Benin (1996, 2001)	0.949	1.104	0.154	0.074	0.082	-0.001	0.073	0.0809
Bolivia (1989, 1994)	1.679	1.145	-0.506	-0.480	-0.024	0.000	-0.480	-0.0238
Bolivia (1994, 1997)	1.145	1.035	-0.109	-0.120	0.012	-0.001	-0.121	0.0115
Brazil (1986, 1996)	1.135	0.330	-0.805	-0.685	-0.072	-0.048	-0.709	-0.0959
Burkina Faso (1992, 1999)	1.441	1.836	0.395	0.256	0.132	0.007	0.259	0.1359
Cameroon (1991, 1998)	0.909	1.218	0.309	0.132	0.197	-0.020	0.122	0.1871
Colombia (1986, 1995)	0.984	0.383	-0.601	-0.309	-0.241	-0.052	-0.334	-0.2670
Colombia (1995, 2000)	0.383	0.389	0.006	-0.003	0.009	0.000	-0.003	0.0095
Cote d'Ivoire (1994, 1998)	0.995	0.871	-0.120	-0.120	0.000	0.000	-0.120	0.0000
Dominican Republic (1986, 1991)	0.920	0.628	-0.292	0.006	-0.299	0.000	0.006	-0.2987
Dominican Republic (1991, 1996)	0.628	0.415	-0.214	-0.204	0.006	-0.016	-0.211	-0.0022
Dominican Republic (1996, 2002)	0.415	0.327	-0.087	-0.056	-0.029	-0.002	-0.057	-0.0301
Ghana (1988, 1993)	1.182	1.159	-0.023	-0.135	0.109	0.003	-0.134	0.1110
Ghana (1993, 1998)	1.159	0.802	-0.357	-0.227	-0.121	-0.009	-0.232	-0.1250
Ghana (1998, 2003)	0.802	1.160	0.357	0.252	0.126	-0.020	0.242	0.1158
Guatemala (1987, 1995)	3.175	2.418	-0.758	-0.706	-0.039	-0.013	-0.712	-0.0454
Guatemala (1995, 1999)	2.418	2.036	-0.381	-0.296	-0.082	-0.003	-0.298	-0.0836
India (1993, 1999)	2.720	2.494	-0.226	-0.118	-0.106	-0.002	-0.119	-0.1069
Kazakhstan (1995,1999)	0.478	0.358	-0.120	-0.021	-0.087	-0.012	-0.027	-0.0932
Kenya (1993, 1998)	1.419	1.426	0.033	-0.178	0.196	0.015	-0.170	0.2034
Kenya (1998,2003)	1.453	1.250	-0.203	-0.052	-0.149	-0.002	-0.053	-0.1497
Madagascar (1992, 1997)	2.198	2.284	0.086	-0.109	0.193	0.002	-0.108	0.1938
Malawi (1992, 2000)	2.466	2.584	0.118	-0.146	0.261	0.004	-0.144	0.2625
Mali (1987, 1995)	0.955	1.703	0.748	0.321	0.460	-0.033	0.304	0.4436
Morocco (1987, 1992)	1.202	0.999	-0.204	-0.138	-0.060	-0.005	-0.141	-0.0626
Namibia (1992, 2000)	1.054	0.859	-0.195	-0.257	0.061	0.001	-0.257	0.0620
Nepal (1996, 2001)	2.183	1.821	-0.362	-0.316	-0.044	-0.001	-0.317	-0.0451
Niger (1992, 1997)	1.732	2.094	0.362	0.368	-0.010	0.004	0.370	-0.0080
Nigeria (1990, 1999)	1.911	2.851	0.940	0.349	0.629	-0.038	0.330	0.6096
Nigeria (1999, 2003)	2.851	1.953	-0.898	-0.464	-0.391	-0.043	-0.485	-0.4126
Peru (1992, 1996)	1.261	0.944	-0.316	-0.253	-0.058	-0.005	-0.256	-0.0602
Peru (1996, 2000)	0.944	0.928	-0.016	0.025	-0.042	0.000	0.025	-0.0421

TABLE 2. Growth and Redistribution Decomposition of the Height Gap Index of Health Status

Senegal (1986, 1992)	0.833	1.055	0.222	0.013	0.210	-0.001	0.012	0.2095
Tanzania (1991, 1996)	1.913	1.974	0.061	-0.017	0.077	0.000	-0.017	0.0770
Tanzania (1996, 1999)	1.974	1.829	-0.145	0.029	-0.175	0.000	0.029	-0.1750
Togo (1988, 1998)	1.133	0.818	-0.316	-0.318	0.008	-0.005	-0.321	0.0052
Uganda (1988, 1995)	1.998	1.687	-0.311	-0.259	-0.051	0.001	-0.260	-0.0516
Uganda (1995, 2000)	1.687	1.617	-0.070	-0.008	-0.061	0.000	-0.008	-0.0614
Zambia (1992, 1996)	1.699	1.945	0.246	0.099	0.149	-0.002	0.098	0.1478
Zambia (1996, 2001)	1.945	2.387	0.441	0.270	0.176	-0.004	0.268	0.1738
Zimbabwe (1988, 1994)	1.024	0.777	-0.247	-0.345	0.080	0.018	-0.336	0.0889
Zimbabwe (1994, 1999)	0.777	1.209	0.432	-0.012	0.441	0.002	-0.010	0.4426