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Mind the Gap! Widening Child Mortality Disparities

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Abstract In parallel to the substantial expansion in global economic transactions and growth during the 1990s, there is evidence that the number of poor has increased and that income disparity among and within countries grew as well. There is, however, considerably less evidence about the situation of children related to these matters. Within this context, this paper explores the evolution of social disparities by analysing the trends in the Under-5 Mortality Rate (U5MR) by wealth level.

It is common knowledge that child mortality is higher among the poorest than the richest. However, the size of this mortality gap or the way it varies in relation to the absolute level of child mortality is not as well known. This paper shows, based on a sample of 24 developing countries with comparable surveys, that the U5MR of the bottom quintile of the distribution of wealth is, on average, 2.2 times bigger than that of the wealthiest quintile. This means that, taking into account the greater fertility of poorer households, a child from a family belonging to the bottom quintile of the wealth distribution is three times more likely to die before age 5 than a child belonging to the top quintile.

The trends over time show that U5MR differentials remained constant over time in a few countries, but worsened in the majority of them. Only two countries with relatively small populations were able to achieve both a reduction in average U5MR and a decline of U5MR disparities. The implications of this finding for achieving the U5MR Millennium Development Goal is discussed. Under the top-down approach, extrapolating past trends, only six of the 24 countries would reach the goal. However, under the egalitarian approach, 16 of them would attain the two-thirds required reduction. The relation between changes in U5MR differentials and changes in income inequality does not seem to be pronounced, thus suggesting that social policy may play an important role in reducing U5MR disparity.

Key words: Children, Mortality, Poverty, Under-5 Mortality Rate, Fertility

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Introduction

We live in a world full of contradictory signals. There has been an unprecedented expansion in global economic transactions but it has been concentrated in only a few parts of the world. Incredible technological progress has occurred but millions of people lack access to the most basic services. A huge increase in wealth is confronted with everlasting misery. Life expectancy increased in many countries, but premature deaths spread due to the HIV/AIDS pandemic. Greater acknowledgement of human rights co-exists with the persistence of different forms of slavery. The Convention on the Rights of the Child has been adopted by practically all countries, but these rights are permanently violated — as evidenced by the millions of children that die or struggle to survive in the worst of circumstances.

These rapid worldwide changes take place in the context of what is now referred to as the globalisation process, a term that assumes a variety of meanings. Focusing on 'economic' aspects, there are two major variables that affect child well-being directly or indirectly. The first is family income, a variable that, in turn, depends on changes in labour market conditions, which are related to the local political and economic conditions as well as the evolving international situation and rules. The second variable affecting child well-being is social policies and programmes towards children, women and families.[1] Developing countries are making efforts to take part in the international economy by introducing a variety of adjustment processes, changes in government structures, the privatisation of social services and decentralisation, and, in many of them, changes in the debt management and trade policies. The social result of these policies and the processes they unleash is at least controversial. While people can enjoy the benefit of the 'communication revolution' and, in some cases, can benefit from trade opening, several scholars present evidence of increasing income concentration and inequity between and within countries (for example, Townsend, 1993; Milanovic, 1999), and there are still many efforts needed to ensure technologies fully deliver on their human development potential (United Nations Development Programme, 2001).

The issue of the impact of these changes on poverty has, naturally, emerged. A wide consensus recognising that poverty is a multi-dimensional phenomenon and that all its aspects need to be urgently addressed has been achieved, as reflected in the Millennium Declaration that placed poverty reduction at the top of the international agenda by setting specific and time-bound goals on the main aspects of poverty. However, in many policy circles, poverty is still measured only in monetary terms. This is not just a technical issue, but in many cases also implies a conceptual approach that prioritises economic growth and income as the central dimension in dealing with the problems of poverty (Ravallion, 1997; World Bank, 2000–2001; Minujin *et al.*, 2002; Townsend and Gordon, 2002). Although economic growth and the reduction of household income-poverty are important for improving child well-being, there is enough evidence that social policies are equally important in this regard and far more than a complement to economic policies

(Cornia *et al.*, 1987; Mehrotra and Jolly, 1997; United Nations Development Programme, 1999). This point is clear in relation with child well-being. For children, public programmes in the fields of survival, early development, education and protection are essential for their development and full membership in society. The fulfilment of these rights is not only a problem of family income, but involves other aspects that range from availability and quality of services to issues related with discrimination and neglect (UNICEF, 2000; United Nations Development Programme, 2000)

One important problem in this regard is the distribution of the benefits of social programmes among different social classes. The relationships among income distribution, poverty, child well-being, and development have been analysed and widely discussed in the literature (see, for instance, Chenery *et al.*, 1974; Cornia, 1999; van der Hoeven, 2000). In contrast, due to the lack of reliable data, less is known on the relation between the intensity and distribution of social programmes and other dimensions of child well-being such as mortality and morbidity[2] (Evans *et al.*, 2001).

In view of all this, this paper aims at documenting changes across countries and through time in the differentials in the Under-5 Mortality Rate (U5MR) for different wealth groups. The considerable number of countries included in our analysis[3] allows one to draw some conclusion in this area. Two sets of comparisons are made. One is a cross-section analysis involving 43 countries for which information on the U5MR, disaggregated according to the wealth of household, has been produced by the World Bank. The second is based on 24 of these 43 countries for which we obtained information from previous rounds of Demographic Health Surveys (DHS). This allows us to examine trends in U5MR differentials by household wealth over the 1980s and 1990s.[4] After a very brief methodological discussion in the next section, the paper then explores the changes in the above differentials as well as their relation with income inequality. The trends in child mortality disparities are also described, in the fifth section, as well as their likely impact on achieving the U5MR Millennium Development Goal and their statistical significance. Their relation to changes in income distribution is then presented. Finally, some working hypotheses are presented in the conclusions.

The many dimensions of disparities

When analysing social differentials in social indicators such as the U5MR, as we do in this paper, there are at least three sets of questions that need to be answered before proceeding with the actual data description. These methodological questions pertain to: (i) What is inequality? Why is inequality important? How is it measured? What thresholds are relevant to characterise a situation as unequal/unfair?, (ii) Whose inequality? Will inequality be measured at the household or individual level? What characteristic or variable will be used to classify individuals/households? How many groups or subgroups is important to use to describe inequalities?, and finally (iii) What methods are used to measure disparity? What sources of data will be used?

What procedures will take place to classify individuals/households? How are inferences going to be made?

The rest of this section attempts to briefly answer some of these questions. There are many reasons that make the analysis of social disparities relevant. One is that there seems to be increasing evidence about growing inequity between and within countries in terms of income, and it is natural therefore to be concerned that a similar pattern may be emerging for key social indicators.[5] Another important reason is that averages in the U5MR are often not very helpful in evaluating social trends. Averages are used to simplify complex realities in easily interpretable summary measures. As such, they are an abstraction. However, by simplifying reality excessively, averages entail large informational costs. In fact, average changes through time that can be interpreted as 'positive' (as the reduction in the U5MR) can be the result of proportional or equal improvements for all members of society or, alternatively, of improvements confined only to a few social strata. Third, because of a lack of comparable cross-country data, we do not know, *ex ante*, what U5MR differential can be considered high, low or 'normal'.[6]

The analysis of disparities can be carried out emphasising different social dimensions such as income level (rich/poor), location (urban/rural), gender (women/men), ethno-linguistic groups, and so on. In this paper we concentrate on the U5MR differentials by different levels of household wealth — as lack of space prevents us from looking at other important dimensions of mortality disparities. Household wealth is approximated by an 'asset index' based on the presence in the household of certain durable goods (such as a radio, a television, or a bicycle), the quality of the dwelling (e.g. roof and floor materials), and access to different types of water and sanitation. The index was constructed following the procedure described in Filmer and Pritchett (1998a, 1998b) and Gwatkin *et al*. (1999). This 'asset index' was then used to stratify the households included in the DHS into quintiles.

There are advantages and disadvantages in using wealth rather than income to rank households; see, for instance, Minujin and Joon Hee Bang (2002). The clearest shortcoming is that the traditional analysis of welfare uses current expenditure (or income when expenditure data are not available). However, it is well known that measuring expenditure and income in field surveys is problematic because, among other reasons, some people might have incentives to over-report or under-report the real figures, due to insufficient recall, and the problem on non-cash income. Using a measure of 'assets wealth' is much simpler and results in less measurement errors as the objects needed to calculate the asset are directly observed by the interviewer. Moreover, the assets represent the previous expenditure of the household, so it is not very different from the more traditional indicator. In addition, following in this line of reasoning, given that we are looking at a social outcome indicator that changes slowly through time and that represents the effect of various influences,[7] it might be more appropriate to use a measure of accumulated stock through the years, the assets, rather than a current variable such as past months' or past years' expenditure (income).

The measure of inequality of the distribution of the U5MR used in this paper is the ratio between the U5MR of the bottom and top quintiles of the distribution of the households ranked according to the value of their asset index. We choose this measure, which we label the 'relative gap', because it is easy to plot (see the next section) and interpret (Kunst 1997; Anand *et al.*, 2001). It also allows us to avoid cluttering the exposition with different inequality measures (which we have in any case used to test the robustness of our results).

Another issue that needs to be highlighted is that the relationship between changes in averages and in relative gaps is not a simple one. A change in the average U5MR could derive from many number of changes in its distribution and in the relative gap. Thus, *per se*, changes in U5MR averages do not imply *a priori* any particular modification in the relative gap. For example, an improvement in the U5MR could go together with increases in the relative gap and could be accompanied by a deterioration among the disadvantaged and vulnerable children. Combining the various possibilities between improvements and deterioration in the average and in its distribution, we obtain the four alternative scenarios presented in Table 1. Not all of them are equally probable to happen. Figure 1 shows, in a graphic way, these different results.

This 2×2 classification based on average results and the relative gap between the top and bottom quintiles, however, may need some further subdivision. This results from the fact that the ratios, or relative performance, expressed in the relative gap may fail to capture the different possibilities of outcomes among the bottom 20%. For instance, 'improvement with inequity' may be the result of a situation where the top 20% gain much more than the bottom 20%. Thus, the average improves while the relative gap widens. But it may also be the result of a deterioration in the bottom 20% accompanied by an improvement in the overall average driven by the gains among the top 20%. Given that we are not only interested in inequity, but the actual outcome among the worse off, the 'improvement with inequity' case may not capture all the information we needed.

Similarly, in 'worsening with protection', both groups see their situation deteriorate and the relative gap reduced. Alternatively, the relative gap can be reduced because the gains among the bottom 20% are small and dwarfed by the losses among the top 20%. In this case, both average welfare and the

TABLE 1. Possible relationships between changes in averages and the relative U5MR gap

	Relative U5MR gap	
Trends	Narrowing	Widening
Average U5MR		
Improving	Best outcome	Improvement for better-off, but not for disadvantaged
Worsening	Worsening with an element of protection of the disadvantaged	Worst outcome

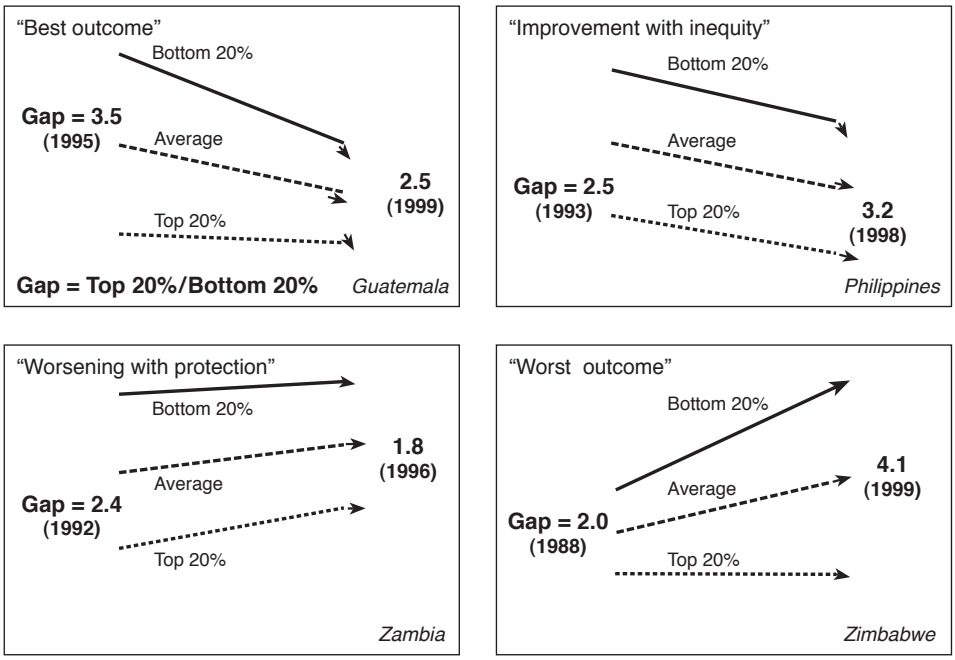

FIGURE 1. Combinations of changes in average level and disparity: some country examples. *Source*: Authors' own calculation based on DHS data.

relative gap are reduced, but the worse-off improve their situation. This is probably not found in actual real-world cases.

Finally, in 'best outcome', there is a further possibility, even if only of theoretical rather than empirical relevance. The average can improve due to major gains among the bottom 20%, and the relative gap can decline if the situation among the top 20% deteriorates (although not as much as the gains among the bottom quintile, thus allowing the average to increase).

A bird's eye view of the differential U5MR across countries

The 'absolute gap', defined as the difference between the value of the U5MR for the bottom and the top quintiles of the wealth distribution, takes into account the level of average mortality. This ratio could indicate a reduction in the absolute gap for lower mortality only because the size of the absolute gap is necessarily reduced when the national average is lower. However, this need not imply that, in relative terms, the bottom quintile is in a more favourable position *vis-à-vis* the top quintile. Thus, we analyse the ratio of the bottom to the top quintile and we call this ratio the relative gap. As was mentioned in the previous section, a shortcoming of this measure is that we lose the information on the level of the national average U5MR. A relative gap of 2 (i.e. mortality in the bottom quintile is twice as high as in the top

quintile) in a country with relative low level of mortality could imply that the U5MR would be 30[8] for the bottom 20% and 15 for the top. In a country with higher mortality, a relative gap of 2 could reflect an U5MR of 140 for the bottom and 70 for the top. However, the relative gap measure is a pure number and allows a comparison of disparities across countries and through time in a standardised way.

In developing countries, every year, more than 7 million children die before reaching 1 year of age, and another 3 million die before their fifth birthday. Many of these early deaths are related to preventable causes. Lack of access to basic health services, immunisation, safe water and sanitation, low levels of maternal nutrition and education, and so on, are the direct causes of this sorry state of affairs. Poverty and discrimination are some of the underlying causes. For instance, while basic health should be a universal entitlement, the evidence shows it varies with a nation's overall wealth level and with its wealth gap. But, how large is the U5MR gap by income/wealth levels? Are there similarities across countries?

The results shows that the relative U5MR gap, defined as the ratio between the U5MR of the bottom and the top wealth quintiles, are significant in most developing countries. When countries are ranked by their average U5MR, the U5MR for the bottom and top quintiles show the pattern depicted in Figure 2. The graph illustrates that an important part of the variability of the absolute gap is due to factors other than the level of the U5MR. Plausible explanations of these differences are disparities in wealth or income distribution or differential access to services.

On average, children belonging to families in the bottom quintile have more than twice the probability of dying before reaching 5 years of age than children living in families in the top quintile. Due to higher fertility rates among the families belonging to the bottom quintile, this implies that seven of their children die for every two that die among the better-off households.

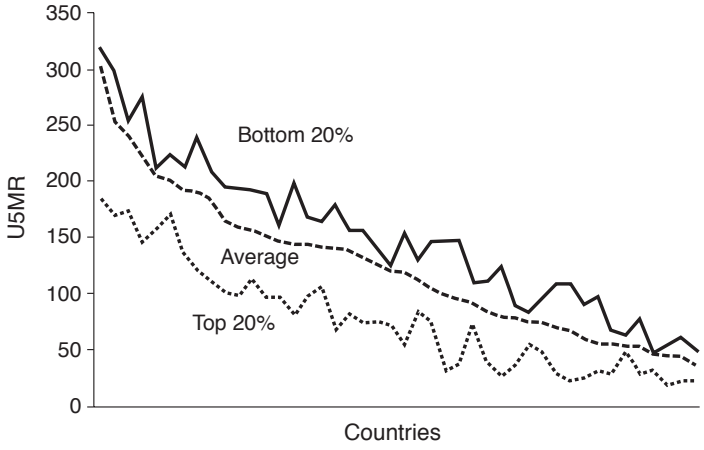

FIGURE 2. The U5MR by country, bottom 20%, average and top 20%, mid-1990s. *Source*: Authors' own calculation based on Gwatkin *et al*. (1999).

Disparities are quite different for different countries. Relative gaps range from 1.3 to 4.7. For these countries the average (weighted by the number of live births) is more than 2. Also, the geometric average and the median are close to 2. The standard deviation is around 0.9. The relative gap is higher than 3 in 20% of the 43 countries analysed. There are many countries around the average, but the distribution is asymmetrical, with more observations above the average than below.

The lowest level is 1.3, so in all the cases the U5MR is higher for the bottom quintile than for the top quintile. In other words, children from families in the top quintile always have a higher probability of survival. Although this may be taken as the 'normal' way things are, it is a clear measure of discrimination in the most basic right, the right to survive.

In the few countries where the relative gap was less than 1.5, the concentration index was not significantly different from 0. Only Bangladesh, Benin, Niger, Pakistan and Zimbabwe showed a concentration index that was not significantly different from 0, and relative gaps between 1.5 and 1.9. Twice as many countries in that range showed concentration indices significantly different from 0.

If we compare the number of children that die in the top and bottom quintiles, in 14 of the 43 countries, more than four children belonging to families in the bottom quintile die for every dead child in the top quintile. For some countries that combine high fertility rates with significant disparities, this relation is higher than five; for example, 5.5 in India, 5.6 in Dominican Republic, or 6.5 in Egypt.

In Figure 3 we can observe the relative gaps by countries ordered by

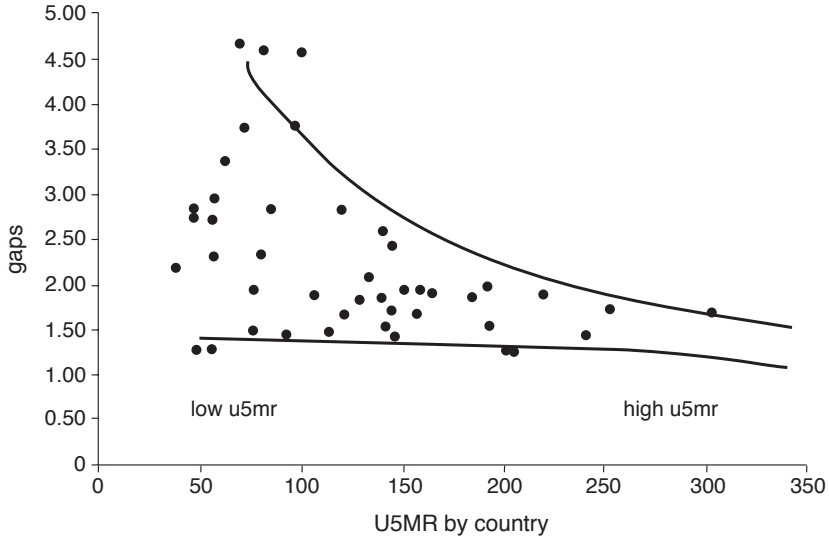

FIGURE 3. U5MR Relative gap by U5MR level, mid-1990s. *Source*: Authors' own calculation based on Gwatkin *et al*. (1999).

increasing level of the U5MR. We can notice that there are higher relative gaps for countries where under-five mortality is between 50 and 150 per 1000 live births than for countries where the U5MR is above 150. More importantly, the dispersion of the relative gaps is higher among countries with relatively lower U5MR. The relationship between disparity and the national average is not very strong, with a R^2 of only 0.2.

What could be derived from this is that, besides the average level of the U5MR and the distribution of wealth, there are other factors that are relevant in relation to disparities. As noted, public policies and income distribution are the two candidates to influence the outcomes of the top and bottom quintiles. In other words, when households are classified by their wealth, the U5MR differential can be explained because of their different levels of income, if income can be used to buy the basic needs required to avoid infant and child mortality. On the contrary, if access is not primarily determined by ability to pay, but the existence of the service itself, income will not be strongly associated with these quintile differentials.[9] This could lead to the following statement: decreasing the average U5MR is important, but improving the situation of the poor and narrowing the existing disparity is also important and requires public social policies as well as a better distribution of assets (and income).

The U5MR and income distribution

In the discussion so far, we have focused on the U5MR differentials by wealth quintiles. One possible explanation for these differences is that, in as much as wealth and income are correlated, disparities in income would be translated to disparities in mortality. Thus, countries with more unequal income distribution would be expected to show larger relative gaps in mortality by quintile. This, however, does not seem to be the case. As the U5MR cannot be estimated for the year of the survey but is estimated for a cohort born at least 5 years prior to the survey date, it would be incorrect to correlate estimated U5MR levels with the income distribution measure of the year of the survey. Moreover, in order to obtain a large enough sample (to increase the reliability of the estimates), several cohorts are usually involved in the estimates. We have analysed infant and child mortality for children born 5–10 years prior to the survey. Thus, the relevant income disparity is not the latest one, but the one prevalent 10 years ago. The measure of income distribution we have used is the ratio of the shares of income of the top and bottom income earners.

This measure is similar to our measure of disparity in the U5MR, in that it looks at the top and bottom quintiles. This measure, then, says that if the ratio is 30, the share of the top earners is 30 times as large as that of the bottom earners. Thus, for every dollar the poorest bottom 20% of the income distribution earn, the richest 20% obtain 30. The average and the median of this distribution, for the roughly 30 countries we have data for, was around 10. The proposition we wanted to test is whether there is any correlation between relative gaps in the U5MR and similar relative gaps in income

distribution. The correlation coefficient between this two variables was only 0.15, a very low level, which indicates a lack of association between income distribution and the inequalities in infant and child mortality.[10]

It is interesting to notice that the wide variability in U5MR relative gaps is not related to the distribution of income in these countries. This seems to imply there are other elements, such as access to social services — as measured, for instance, by educational attainment of the mother or pregnant women who attended regularly antenatal services — that are more closely associated with the level and distribution of the U5MR.

For whom did child survival improve? The achievement of the infant mortality goals and disparities during the 1990s[11]

The goals formulated at the World Summit for Children in 1990 refer to changes in average situations, as the Millennium Development Goals (MDGs) also do. In the case of infant and child mortality, it was "Reduction of 1990 under-5 mortality rates by one third or to a level of 70 per 1,000 live birth, whichever is the greater reduction". For the MDG, it has been reformulated as a two-thirds reduction from the 1990 levels.

The global changes over the period 1990–2000 show that the world U5MR fell from 93 to 83 per 1000 live births, a decrease of 11%. As seen in Figure 4, the U5MR decreased in all regions but at a different pace (UNICEF, 2001).

However, changes in mortality differentials for the second half of the 1990s are not yet known.[12] The estimated regional levels[13] of child mortality for the top and bottom quintiles around the mid-1990s (or earlier depending on the date of the DHS) show that the situation of the bottom 20% was still worse than the average situation at mid-point of the 1980s (see Fig. 4).

To understand the path followed by the child mortality decline over time, we need to have information on disparity trends for the 1980s–1990s. The analysis on changes from the mid-1980s to the mid-1990s on the U5MR in the different quintiles reveals two important features. One is that, on average, the U5MR improved or remained constant for most of the 24 countries analysed.[14] Among the few exceptions were Kenya and Zimbabwe. As these are countries severely affected by HIV/AIDS, the pandemic could be, among others, the explanation for the reversal of progress regarding the U5MR.[15]

Second, is that the analysis on the U5MR changes by wealth group; in most of the cases the improvement for the top quintile was statistically significant for most countries, while for the bottom quintile it was not significant in the majority of the countries. As can be observed in Figure 5, for a group of selected countries, the better-off benefit extensively more from the improvement on mortality than the worst-off. For example, in the case of Mali, the U5MR was 322 for the bottom quintile and 194 for the top quintile at the beginning of the period, changing to 307 and 169, respectively. This implies that the reduction for the bottom quintile was 4.7% while that

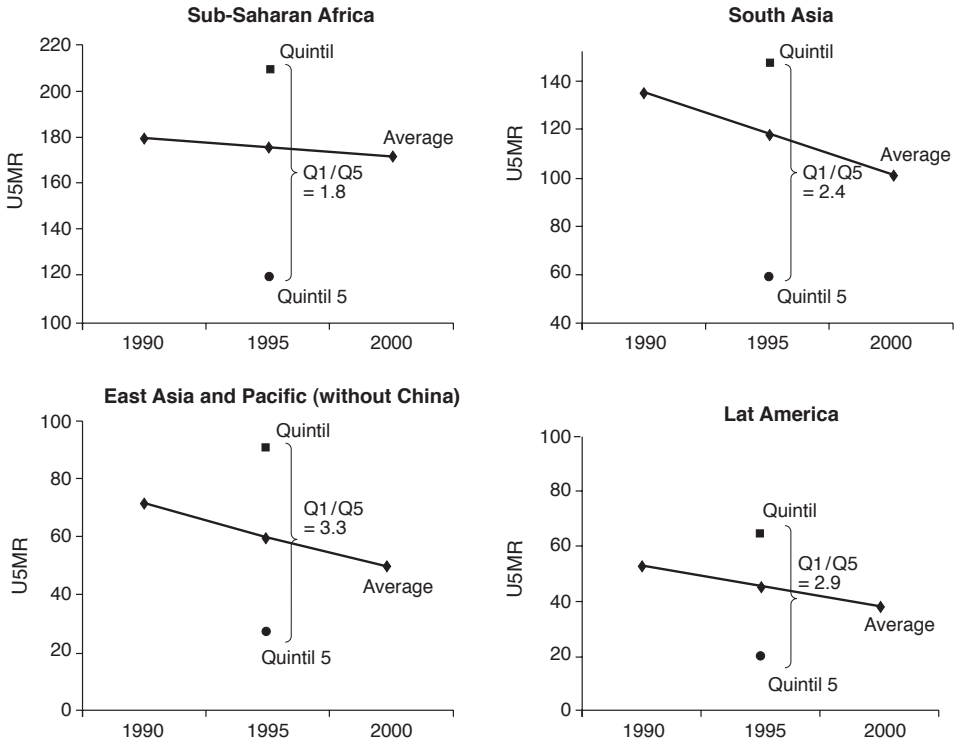

FIGURE 4. Change in the U5MR by regions 1990–2000, and levels of U5MR for bottom and top quintiles by the mid-1990s. *Source*: Based on UNICEF (2001) (for regional average) and DHS for quintiles.

for the top quintile was 12.8%. Similarly, the Dominican Republic moved from 103 for the bottom quintile and 59 for the top quintile at the beginning of the period to, respectively, 90 and 29 at the end of the second period; that is, the reduction in the U5MR was 12.7% for the worst-off households, and more than 50% for the better-off ones. These differences in the rate of improvement were observed in almost all the cases.

All this implies that the relative gap, calculated as the ratio between the bottom and the top quintiles, increased over time. For the case of Mali, the gap was 1.6 at the beginning and increased to 1.8. For Dominican Republic, the change in the gap was from 1.7 to 3.1.

When analysing trends in the relative gap for the 24 countries, it becomes clear that inequality on the U5MR has increased between the better-off and the worst-off.[16] Figure 6 plots the values of the gaps at the first period of analysis against the second period for the 19 countries where the U5MR declined between these two survey rounds.[17] It can be observed that most of the countries are in the upper quadrant of the graph, which implies that the gap in period two was greater than in period one. The average gap was 2.4 for period one, and increased to nearly 3 by the second period.

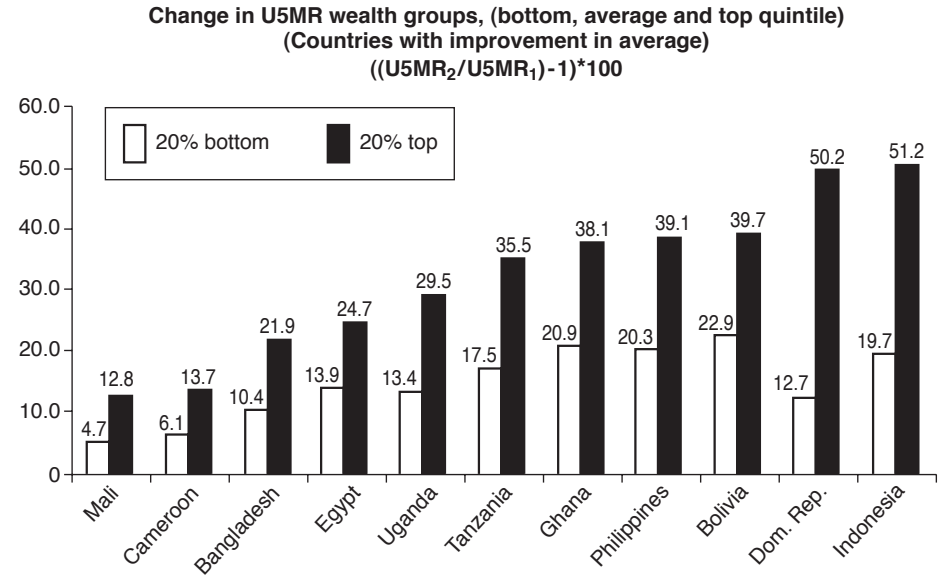

FIGURE 5. Most U5MR reduction takes place among the wealthiest. *Source*: Authors' own calculation based on DHS data.

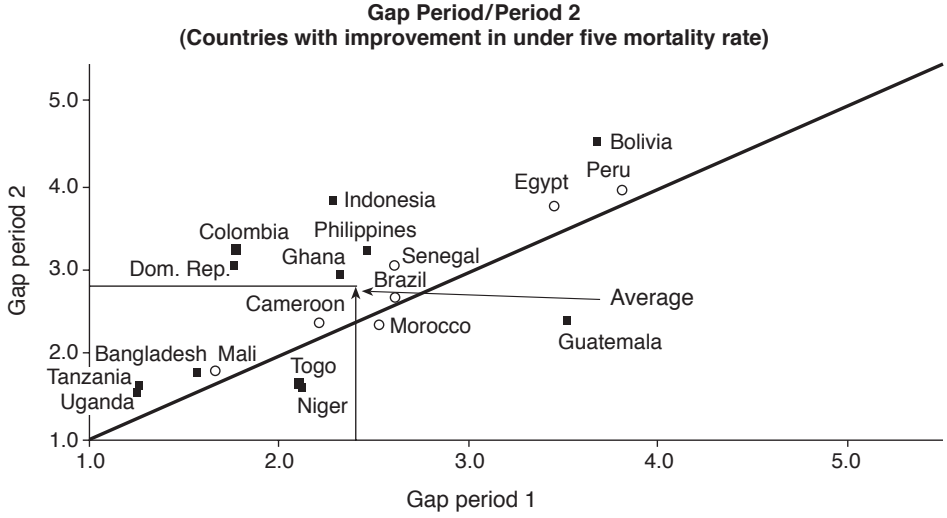

FIGURE 6. Changes in the relative gap, mid-1980s and mid-1990s. *Note*: Circles represent countries where the changes in disparity are not statistically significant, and squares represent countries where the changes are statistically significant (see section on statistical significance below). *Source*: Authors' own calculation based on DHS data.

Disparity reduction and the MDGs

The pace of these changes in the relative gap is very significant in terms of reaching the MDG of reducing the U5MR by the year 2015 to two-thirds its level in 1990. As discussed earlier, disparities in the U5MR between the wealthy and poor are significant and there are different ways of achieving the reduction of the national average goal. There are, *in extremis*, two ways to accomplish the reduction required to satisfy the goal (Gwatkin, 2000). One is the top-down approach, which reduces mortality first for the top quintile to its minimum level, then for the next quintile, and so on. In this approach the bottom quintile is the last one to receive the benefits of U5MR reduction.[18] Alternatively, in the bottom-up approach, the procedure is inverted.[19] First the gains accrue to the bottom quintile, and only when this is at a minimum U5MR do reductions take place in the second quintile. In both cases, the country could achieve the same level of the U5MR but the results in terms of distribution of mortality gains among the population are fundamentally different. This point was raised at the time of the World Summit for Children (WSC) (Rohde, 1989), and it is relevant today. In practice, the historical experience, as just described, is closer to the top-down approach.

As it would be impossible and unfair to prevent U5MR reductions among groups, we simulated a slightly different version of the bottom-up approach, which we label the 'egalitarian approach'. In this case, we allow each quintile to improve at the pace of the quintile whose U5MR was reduced the fastest in the past. Thus, all children improve their situation, nobody waits, and they do so at the same pace. Figure 7 illustrates that, while the average accumulated rate of reduction was 14% for the bottom quintile for the 24 countries, it was almost 30% for the households in the top quintile. The egalitarian approach would result in all quintiles reducing the U5MR at the

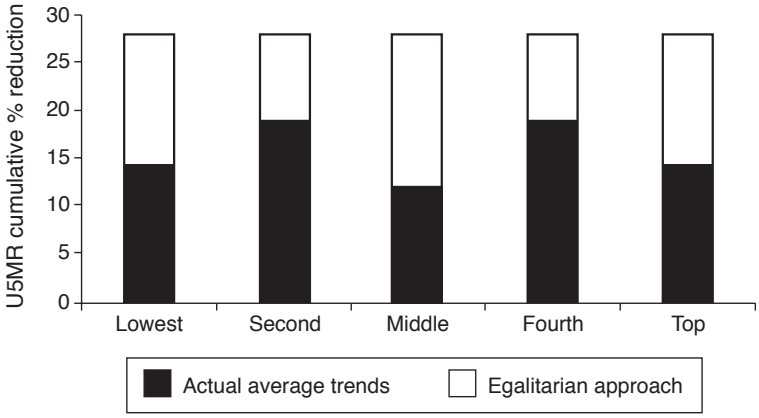

FIGURE 7. Actual rates of the U5MR decline by quintile and the egalitarian approach. *Source*: Authors' own calculation based on DHS data.

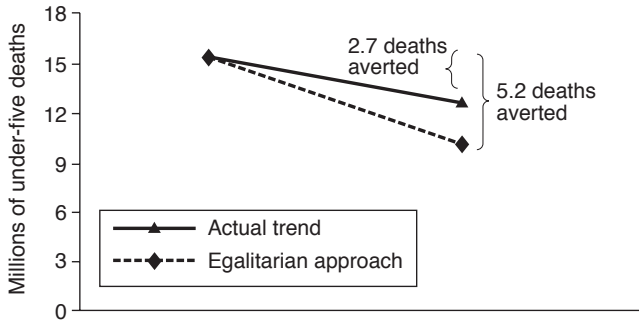

FIGURE 8. Children's lives saved, comparing actual trends with an egalitarian approach. *Source*: Authors' own calculation based on DHS data.

accumulated rate of almost 30%. As we are using observed rates of reduction, it is difficult to argue that they are not feasible due to technological or country-specific constraints.

Given the rate of reduction in each quintile observed in the past 10 years,[20] the number of lives saved in these 24 countries can be estimated. This results in 2.7 million deaths averted. However, if the egalitarian approach had been used, the numbers of averted deaths would have been more than twice as large (5.2 million). This difference can be observed in Figure 8. In other words, while the observed decline in the U5MR was from an average of 127 to 105, under the egalitarian approach the reduction would have been 20% higher, reaching an average U5MR of 85 (i.e. around 20% lower).

The implications for the MDG are striking. Under the top-down approach, extrapolating past trends, only six of the 24 countries would reach the goal. However, under the egalitarian approach, 16 of them would attain the two-thirds required reduction.

Statistical significance of the changes

There is, however, an important issue regarding the temporal changes discussed above. It refers to whether the observed differences in the relative gaps represent actual trends, or whether they are a statistical artefact. In other words, given the sample sizes, the errors around the quintile estimates are large and it may be that the differences are only due to random sampling. The inputs for doing this statistical analysis are the standard errors of the variables in each period.[21] From there we need to derive the reliability of changes in gaps, which are ratio estimators. After looking at different alternatives, finally we decided on the following approach. We compared the changes between periods for the bottom quintile and found that, in most cases, there were no statistically significant differences.[22] Then we followed the same procedure for the top quintile and noticed that, in about one-half of the countries, there were statistically significant improvements. Clearly,

TABLE 2. Changes in the average U5MR and the relative gap, 1980s and 1990s, in selected countries

	Relative gap		
Trends	Narrowing	Constant	Widening
Average			
Improving	Guatemala	Egypt	Bangladesh
		Mali	Bolivia
		Morocco	Colombia
		Peru	Dominican Republic
		Senegal	Ghana
			Indonesia
			Uganda
Constant	Togo	Brazil	Philippines
	Zambia	Burkina Faso	Tanzania
		Cameroon	
		Niger	
Worsening		Kenya	Kazakhstan
			Zimbabwe

Source: Based on DHS data.

then, there were increases in disparity due to the lack of progress of the bottom quintile.[23]

In terms of the classification proposed in the second section, Table 2 shows, for 24 countries, both the changes in the average level of the U5MR and the changes in the relative gap. These trends in child mortality disparities show that within-country inequities have remained constant or narrowed in some countries, and worsened in most of the others. Only two countries, with relatively small populations that comprise less than 2% of our sample, were able to achieve both improvements in average and reduction of disparities.

The discussion in the earlier section also introduced the possibility that some of these changes in averages and disparities might include cases where either the top or bottom quintiles suffered increases in the U5MR that are 'compensated' by the other group. In other words, some of the cells in Table 2 might require additional subdivisions. In the three cases where disparities changed while the average worsened (Zambia, Kazakhstan, and Zimbabwe), further classifications are not required within the cells as all the cases are straightforward. In Zambia, the decline was led by increases in the U5MR among children from the wealthiest households, but the mortality among children from the bottom quintile did not decline. Similarly, in the other two countries, the decline was led by increased mortality for the bottom quintiles but there were no improvements among the richest households.

These statistical results support the analysis, which can be summarised in the following way.

- The U5MR average reduction is mostly driven by the reduction experienced by the middle and top income groups. Meanwhile, the reduction in

child mortality among the poor has been considerably lower, most often statistically insignificant.

- The story that these trends tell us is clear. First, the relative gap between the rich and the poor U5MR increased during the 1990s. Second, this is because the decrease of child mortality was much higher for the top quintile than for the bottom quintile.

Changes in U5MR disparity and in income distribution

For the 24 countries analysed, the evidence seems to indicate there has been a general increase in U5MR differentials by wealth level. For about one-half of them, the increases in disparity were strong enough to pass various significance tests. However, the question remains about what other changes were taking place at the same time in these countries. In this section we analyse trends in income distribution. Following the analysis earlier, we analyse the trends in U5MR differentials by wealth levels and the relation to changes in income distribution. The latter variable is available only for 18 of these 24 countries included in the earlier analysis, not a large enough sample for a sophisticated econometric investigation. Rather, a much simpler way of looking at these variables is presented in Table 3, which classifies countries according to whether the income relative gap was becoming wider or narrower and a similar classification for the U5MR relative gap. A few countries could have been assigned to the category 'no change' under one or the other classification (Table 3, asterisks).

Although only Kenya shows a (non-significant) narrowing of both gaps, it is difficult to establish a pattern linking trends in income inequality to those in U5MR differentials. Among the countries where income distribution

TABLE 3. Changes in income distribution and in U5MR disparities

	U5MR gap narrower	U5MR gap wider
Income gap narrower	Kenya*	Bangladesh Brazil Ghana Tanzania Senegal* Philippines Zimbabwe**
Income gap wider	Guatemala Morocco* Niger* Zambia	Bolivia** Colombia Indonesia** Dominican Republic Uganda Peru*

Source: Own estimate based on DHS and the WIDER database.
*Countries where U5MR gap changes are not statistically significant
** Countries where income gap changes are not statistically significant

became more unequal, the same number experienced either an increase or a reduction in U5MR differentials. The countries where the U5MR differential increased, the most common occurrence in this group of 18 countries, are roughly evenly split between countries with more equal or unequal income distributions.

The countries presented in Table 3 can be arranged according to the magnitude of the changes in either variable. These changes can be expressed in absolute or percentage terms. Figure 9 shows the lack of correlation between changes in U5MR differentials and changes in income inequality.

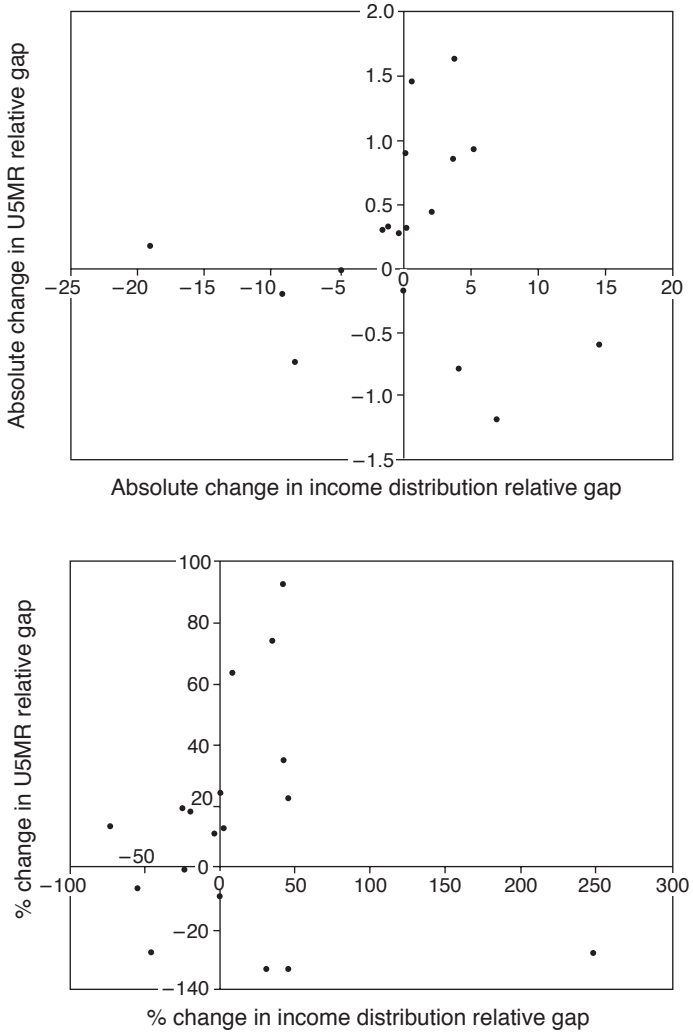

FIGURE 9. Absolute and percentage changes in the U5MR relative gaps and income gaps. *Source*: Authors' own estimate based on DHS and the WIDER database.

Final comments

The following is a summary of the findings and hypothesis that can be derived from the analyses carried out in this paper.

1. U5MR differentials by wealth level and other social dimensions were found to be significant in most of the 43 countries analysed cross-sectionally.
2. In the case of wealth disparities, the relative U5MR gap between the bottom and top quintiles is, on average, 2.2, with a range of variation going from 1.3 to 4.7. For one-third of the countries the relative gap is higher than 2.5. This implies that more than three children from families at the bottom of the distribution die for each child who dies in families at the top of the distribution.
3. The dispersion of the relative gap was found to be higher, the lower the level of the U5MR. In countries with more than 130 child deaths per 1000 live births, the U5MR relative gap ranges from 1.7 to 2.5, and most of them are below 2. For countries with a U5MR of less than 100 per 1000, the relative gap ranges from 1.3 to 4.7, with most of the countries beyond 2.3.
4. The analysis of trends in U5MR differentials for 24 countries with at least two DHS over the 1980s and 1990s shows that the U5MR differentials between poor and rich households increased during the 10 years studied. The observed reduction in the average U5MR is mostly driven by the reduction experimented by the middle and top social groups. The U5MR reduction for the poor was modest, and in most countries it was not statistically significant.
5. Most of the countries implicitly follow a 'top-down' approach, whereby the poorest households are queuing to get the benefits of policies and intervention to reduce their U5MR and fulfil their rights.
6. If a more 'egalitarian' pattern had been followed (i.e. if all household quintiles had enjoyed the same pace of U5MR decline as the top quintile), the U5MR of the poorest group would have been more than 20% lower, and twice as many children's lives would have been saved.
7. The implications for the MDG are striking. Under the top-down approach, extrapolating past trends, only six of the 24 countries would reach the goal. However, under the egalitarian approach, 16 of them would attain the two-thirds required reduction.
8. All of this suggests undertaking further research on the following topics:

   - There are different alternatives for achieving a lower level of infant mortality; some of them are much more equitable than others. Which paths have different countries actually followed?
   - Particular efforts should be made to improve the situation of the poor. The universal provision of Basic Social Services has been shown by several studies as one key measure for that purpose. Is there a pattern between globalisation and provision of Basic Social Services?

- What public policies, on top of better distribution of assets and income, are crucial to narrowing the U5MR relative gaps and improving the situation of the poor?
- Can/should national average goals be complemented with goals (and monitoring) on disparity reduction or in relation to the poorest groups?

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Notes

1 It must be highlighted that legal and institutional aspects are also crucial to ensure the realisation of child rights, but these will not be considered explicitly on this occasion.

2 Life expectancy at birth in developing countries depends closely on infant and under-5 mortality, and is often used as a key indicator of development. Thus, Sen (1995) points out that "The influences that increase or reduce mortality often have economic causes, and there is a prima facie reason for not dismissing mortality as a test of economic performance ... Also the focus on mortality has strong 'associative' features. Mortality and morbidity often go together, and so do, frequently enough, other correlates ... In fact, differential mortality rates are significant indicators not only over time, but also across different groups". (p. 7).

3 The results presented in this paper are part of a larger research project on disparities in child welfare indicators and their trends carried out at the Division of Policy and Planning of UNICEF. It needs to be highlighted that countries included in this analysis are those with one or more Demographic and Health Surveys. These countries represent about 40% of the population in developing countries excluding India and China.

4 Up to now the trends in terms of relative gaps are basically unknown, and the little information available shows an increase in relative gaps for some countries (Sahn *et al.*, 1999; Stecklov *et al.*, 1999).

5 For reasons of space, we are not going to discuss fundamental issues about the nature of inequality (see Atkinson, 1983; Sen, 1997).

6 In terms of income, for instance, it is known that Gini coefficients of 0.6 are large, and 0.2 is low.

7 By definition, the elements that affect under-5 mortality take place during 5 years.

8 In the rest of the paper, as it is customary, the U5MR is expressed as a rate per 1000 live births.

9 Clearly, income, wealth, access to services and geographic location are correlated. Whether poorer areas are underserved because the inhabitants are poor, or people are poor because they live in underserved areas, the effect could be confounded when using all dimensions in the statistical analysis. Here we concentrate on wealth for reasons of space, although analysing the ratio of the worst to the best province or administrative area (a measure similar to our relative gap) yields analogous magnitudes of disparity and trends.

10 A similar exercise was carried out with the more traditional Gini coefficient measure of income inequality and the results were very similar, with a correlation coefficient of only 0.20. The ratio of the income share of the top 20% to the bottom 20% of income earners was calculated from data included in the World Income Inequality Database of WIDER (www.wider.unu.edu), which provides also Gini coefficients.

11 Besides the results reported in this section, the project on 'Disparity Trends on World Summit for Children's goals', (note 3) also included the analysis of the following dimensions: antenatal and delivery care, immunisation, nutrition, and education.
12 As is usually the case with household surveys, the method used for calculating the U5MR places the estimation 5 years prior to the date of the gathering of data from the field.
13 Weighted average for the countries, with information by region.
14 As we explained above, the number of countries were limited by the fact that trend analysis requires at least two comparable DHS rounds.
15 The trends for the Infant Mortality Rate (IMR) in eight countries analysed by Sahn *et al*. (1999) look the same, with the exception of Mali, Zambia and Zimbabwe. It should be noticed that they have evidence for Ghana that overlaps with ours. This indicates that disparities in the IMR are smaller than in the U5MR. This is a reasonable conclusion as mortality in the first year of life is influenced less by contextual factors (many of which are related to socio-economic status and captured in our wealth classification) than in later years.
16 For details on U5MR gap changes and on the methodology used, see Minujin and Delamonica (2003).
17 However, not all changes, either for the national average or for disparity, were statistically significant (see section on statistical significances of the changes).
18 The hypothesis of 'queuing' for basic social services is explored in Vandemoortele (2001).
19 Evidently, these are simplifications for exposition.
20 Extrapolating the inter-surveys results from the DHS, this exercise was carried out independently for each country.
21 Because DHS are cluster surveys, a specific formula (provided by Macro, the organisation in charge of carrying out the DHS) is required to estimate these standard errors.
22 For a poignant discussion of the misguided reliance on strict application of *t*-tests, without taking into account the 'broad' picture that the data present, see McCloskey and Ziliak (1996).
23 Bolivia, Brazil and Ghana represented slightly more difficult cases, as both quintiles showed improvements. However, the rate of reduction in the top quintile was at least twice as fast as in the bottom quintile. Thus, we concluded that for these countries there has also been an increase in disparity.

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Appendix: under-5 mortality rate by wealth quintile

Country	Year	Under Five Mortality Rate by wealth quintiles						Gap	Change	
		1	2	3	4	5	Total		Gap	Average
Africa										
Burkina Faso	1992	225,9	241,6	247,3	217,2	160,9	219,8	1,4	10,5	5,0
	1999	255,9	234,4	247,1	244,6	165,0	230,7	1,6		
Cameroon	1992	221,8	170,5	152,2	125,8	100,3	156,7	2,2	8,7	-3,7
	1998	208,2	195,6	129,5	112,6	86,6	150,9	2,4		
Egpyt	1988	188,9	168,2	126,2	98,3	54,9	131,6	3,4	7,1	-27,1
	1992	174,4	151,7	118,3	75,7	54,1	121,0	3,2		
	1995	150,2	116,4	91,3	53,8	40,7	95,9	3,7		
Ghana	1988	196,0	156,2	142,2	152,0	110,7	153,8	1,8	67,6	-28,2
	1993	168,9	179,6	146,9	129,9	72,8	143,4	2,3		
	1998	133,6	122,5	122,4	100,4	45,0	110,4	3,0		
Kenya	1989	96,1	89,0	91,9	87,4	47,3	83,8	2,0	23,7	23,6
	1993	134,4	108,7	69,6	78,1	51,0	90,8	2,6		
	1998	142,7	131,8	92,0	78,9	56,8	103,6	2,5		
Mali	1987	321,8	377,9	269,3	324,0	194,2	305,2	1,7	9,3	-15,4
	1996	306,6	280,4	278,9	234,2	169,3	258,1	1,8		
Morocco	1987	168,9	141,3	110,0	126,7	66,9	126,3	2,5	-6,3	-33,3
	1992	109,3	77,3	96,2	70,9	46,2	84,3	2,4		
Niger	1992	379,1	352,7	346,4	307,0	177,9	344,0	2,1	-23,1	-9,1
	1998	328,5	348,5	330,2	320,0	200,4	312,8	1,6		
Senagal	1986	300,0	238,3	186,5	157,3	89,4	210,8	3,4	-10,2	-33,3
	1993	205,8	214,2	180,3	131,7	73,5	165,7	2,8		
	1997	200,2	167,5	145,0	102,7	66,4	140,6	3,0		
Tanzania	1992	182,7	156,1	170,4	159,6	144,6	163,6	1,3	27,9	-7,1
	1996	150,8	178,2	172,0	154,8	93,3	152,0	1,6		
Togo	1988	211,7	169,6	177,9	128,9	101,0	164,6	2,1	-19,6	-11,2
	1996	168,6	169,7	148,5	119,6	100,1	146,1	1,7		
Uganda	1988	221,1	193,1	183,8	164,0	176,4	190,1	1,3	22,8	-15,0
	1995	191,5	165,8	162,1	162,1	124,4	161,5	1,5		
Zambia	1992	218,1	209,4	185,1	146,4	92,8	172,3	2,4	-23,3	10,2
	1996	229,0	216,5	200,0	165,5	127,1	189,9	1,8		
Zimbabwe	1988	94,7	123,0	81,7	74,7	47,8	89,0	2,0	105,5	-4,3
	1994	72,3	73,6	64,8	77,6	43,4	66,6	1,7		
	1999	114,8	90,0	90,1	93,5	28,2	85,2	4,1		
Latin America										
Bolivia	1987	188,0	163,1	137,6	104,8	51,2	140,8	3,7	27,8	-29,6
	1994	185,4	158,5	138,1	109,4	55,9	121,5	3,3		
	1998	145,0	115,4	105,4	52,1	30,9	99,1	4,7		
Brazil	1986	127,1	159,3	75,7	50,0	47,9	103,3	2,7	-0,8	-39,4
	1996	86,1	83,3	53,1	42,4	32,7	62,6	2,6		
Brazil (Northeast)	1986	194,2	182,7	193,9	192,1	92,9	178,0	2,1	19,7	-44,6
	1991	150,7	144,4	138,3	91,9	83,9	126,5	1,8		
	1996	104,6	118,8	128,5	79,2	41,8	98,7	2,5		
Colombia	1986	76,0	64,0	48,8	36,4	43,2	57,7	1,8	85,9	-31,7
	1990	59,0	48,6	33,1	31,6	46,5	44,7	1,3		
	1995	50,7	38,1	45,2	42,9	15,5	39,4	3,3		
Dom. Rep.	1986	102,9	96,9	105,2	79,5	58,8	92,1	1,8	75,3	-33,8
	1991	145,6	102,0	93,6	68,3	57,3	102,9	2,5		
	1996	89,9	69,1	62,4	39,2	29,3	61,0	3,1		
Guatamala	1987	146,4	146,4	132,5	96,4	58,5	124,2	2,5	-2,3	-46,0
	1995	101,3	106,0	82,4	71,7	28,7	83,5	3,5		
	1999	65,5	80,6	93,6	56,2	26,8	67,1	2,4		
Peru	1986	163,2	127,5	92,6	61,9	31,7	112,9	5,1	-22,1	-33,1
	1992	149,7	122,6	81,7	51,6	39,3	101,3	3,8		
	1996	122,3	81,3	56,0	43,5	30,5	75,5	4,0		
Others										
Bangladesh	1994	177,4	156,0	171,4	142,9	113,5	159,1	1,6	14,7	-15,2
	1997	159,0	158,5	127,8	127,9	88,7	134,9	1,8		
Indonesia	1987	134,7	137,9	117,1	91,5	59,1	110,3	2,3	64,6	-36,0
	1991	122,7	141,5	121,3	107,1	62,0	112,8	2,0		
	1997	108,2	74,1	77,1	46,8	28,8	70,6	3,8		
Kazakhstan	1995	33,6	40,7	39,3	46,3	59,0	43,0	0,6	543,8	40,2
	1999	89,1	67,0	64,5	45,0	24,3	60,3	3,7		
Philippines	1993	98,8	91,2	60,2	33,8	40,2	70,2	2,5	30,7	-20,9
	1998	78,7	64,4	50,8	40,6	24,5	55,5	3,2		