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Getting Progress Right: Measuring Progress Towards the MDGs Against Historical Trends

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Getting Progress Right: Measuring Progress Towards the MDGs Against Historical Trends

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Abstract Most numerical targets within the framework of the Millennium Development Goals (MDGs) are overly ambitious for the poorest countries when interpreted as country-specific goals. As a consequence, the current system undermines accountability and ownership and jeopardizes the public support the MDGs have drawn in the past. This paper proposes an alternative approach to evaluating progress towards non-income MDGs that allows a sensible appraisal of countries' progress. We first estimate transition paths towards high levels of achievement for three MDG indicators (under-five mortality, primary completion, and gender equality in education). In line with previous empirical work, we find that the sigmoid-shaped transition path captures several features of past transition episodes. Accounting only for initial levels and time elapsed, our models explain up to 80 percent of the within-country variation in the data depending on the indicator considered. Estimated transition paths are then used to project progress towards high levels of achievement since 1990. Comparing actual with projected progress allows us to identify over- and underachievers based on realistic expectations. For example, we find that while some countries in Sub-Sahara Africa have in fact shown considerable performance towards low levels of under-five mortality, the bulk of the the countries in that region is still lagging behind. Finally, we provide some preliminary regression results.

Keywords: millennium development goals; human development; mortality transition; education transition.

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1 Introduction

The Millennium Development Goals (MDGs) supply policy makers and their constituencies with quantifiable targets, most of which are to be achieved by 2015. For example, the MDGs demand the attainment of universal primary education (MDG2) or the reduction in under-five mortality by two-thirds relative to its level in 1990 (MDG4). Accordingly, the UN frequently assesses whether a country is on-track or off-track to meet these goals by comparing observed rates of progress to rates required to meet the targets.

Several recent contributions have argued that this has led to a perverse situation in which the least developed countries are doomed to fail no matter how their performance compares to their peers' or to past experience [Clemens, 2004, Clemens et al., 2007, Easterly, 2009]. Most MDGs—no matter whether they are defined in terms of levels to be achieved or relative changes—become harder to attain the less developed a country.

These conceptual problems in assessing progress undermine the credibility of the MDG system and jeopardize the public support the goals have drawn in the past. Drawing up realistic targets, on the other hand, would improve the effectiveness of the MDG system. First, moving to realistic targets might prevent the public in donor countries from concluding that development aid does not deliver the goods, what is generally refered to as "aid fatigue" [Easterly, 2009]. This is all the more a problem given that donor countries will face more severe budget constraints in the future. Second, Policymakers cannot be held responsible for not reaching targets that were not attainable in the first place. Realistic, country-specific targets would provide constituencies in developing countries with a yardstick against which their country's progress can be judged. Implementing realistic targets would thus improve accountability.

This paper addresses these shortcomings of the numerical targets as they are interpreted today. We argue that progress towards the MDGs should be judged against what has been observed in the past taking into account countries' starting levels. To show this, we first estimate transition paths for three non-income MDG indicators: under-five mortality rates (MDG4), primary completion rates (MDG2), and the ratio of girls to boys in secondary education (MDG3). Our results are in line with previous empirical work suggesting that progress towards high levels of human development follows an s-shaped (logistic) transition path [Meyer et al., 1992, Clemens, 2004, Clemens et al., 2007, Lay, 2010].

Second, we analyze how one would judge progress today if one takes into account past experience and the level from which each country started. Our estimates of "average" transition paths allow us to calculate country-specific performance indices as the ratio of actual to expected progress. We argue that it is worth considering replacing the MDGs' numerical targets with such a set of country-specific, realistic goals by 2015.

Several other authors have proposed new methods to evaluate progress towards the MDGs. Leo and Barmeier [2010] compare absolute and relative changes to required changes assigning a score of unity if countries achieve the target based on linear projections and, somewhat arbitrarily, a score of one half if they achieve half of the required progress to account for different starting levels. Fukuda-Parr and Greenstein [2010] follow a different approach. They argue that faster progress in the post-MDG decade signals political commitment to the MDG framework. Thus, achievement should be judged according to whether or not progress in absolute terms has accelerated after implementation of the MDG system. Based on a pre-post comparison of annual absolute changes, they find that for the majority of indicators and countries progress has not accelerated. This finding is consistent with our empirical findings that absolute changes in indicators decrease the higher the initial level (for indicator for which higher values signal a higher level of development).

Hailu and Tsukuda [2011] base a pre-post comparison on Kakwanis 1993 method.[1] While this method takes into account that further progress becomes more difficult to attain the closer a country is to achieving a target, it also has two shortcomings: first, if transitions towards levels of higher achievement follow an s-shaped path, it will be more difficult to bring about a given absolute change both a low and high levels of achievement, while Kakwani's method only takes into account the latter. Second, the parameter that determines how much more a given absolute change is valued at higher levels is not estimated from the data but set arbitrarily by the authors.

[1] Kakwani [1993] derives a class of achievement and improvement functions on the basis of three parameters: an upper bound, a lower bound, and a parameter that determines how the same absolute change translates into progress at different initial levels.

The paper is organized as follows: section 2 looks at trends in under-five mortality over the 1990–2009 period. In section 3 we develop a stylized model to explain the evolution of an s-shaped transition path which we then link to our empirical approach. In section 4 we estimate transition paths towards low levels of under-five mortality and high levels in primary completion and gender equality in secondary education. In section 5 we define our performance index based on these estimations and compare it to the performance measure for under-five mortality implicitly defined through the numerical target. Section 6 presents some preliminary results from regression analysis. Section 7 concludes.

2 Trends in under-five mortality, 1990–2009

In the case of MDGs defined as absolute targets like universal primary education (MDG2) and gender parity in education (MDG3) it is obvious that they are more challenging for countries starting at lower levels of achievement. Recent contributions by Clemens et al. [2007], Vandemoortele [2009] and Easterly [2009] argue that this is also the case for MDGs defined in relative terms like the reduction of under-five and maternal mortality by two thirds and three fourths, respectively. Vandemoortele [2009], one of the co-architects of the MDG system, argues that the numerical targets were arrived at by linear extrapolation from global trends until 1990 over the 1990-2015 period. Thus, the MDGs were to be reached at the global level rather than at the country-level. Nevertheless, for lack of further coordination between actors as to how much each country would have to contribute in order to attain these goals, the numerical targets are usually interpreted as national policy goals. National governments, NGOs, and even UN agencies frequently interpret the specific targets at the country-level.

The point is restated by figure 1 which plots absolute and relative annual changes in under-five mortality over the 1990–2009 period against inital levels in 1990.[2] The left panel shows a narrowing of the gap between countries in absolute terms, a common finding in the literature. For example,

[2] Data for under-five mortality is provided by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA, UNDP) through the World Bank's World Development Indicators 2011 database.

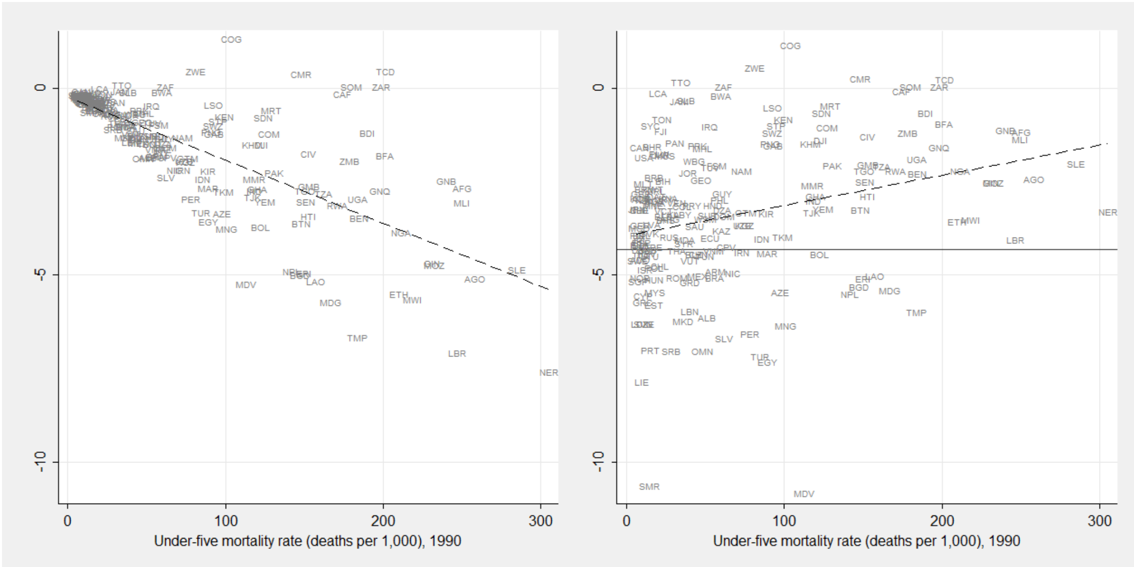

Figure 1: Absolute (left panel) and relative (right panel) annual changes in under-five mortality rate (per 1,000 live births) between 1990 and 2009 against initial levels for 191 countries. The horizontal line in the right panel indicates the average annual rate of reduction required to meet MDG4 (about 4.3 percent).

Kenny [2005] finds evidence for convergence in most quality-of-life indicators between countries. The intuition behind this is rather perspicuous: given the right policy environment, it is often possible for high-mortality countries to make rapid progress by implementing readily available, cost-effective policies that have an immediate effect on mortality. Countries at lower levels of mortality, on the other hand, need to implement more sophisticated (and more expensive) policies to further push down the mortality rate.

The right panel shows that the expected relative rate of reduction is lower in countries starting with higher inital levels. This is at the heart of the criticism of MDG4: the higher a country's initial level of mortality, the less likely it is to achieve a given rate of reduction. In particular, note that there is not a single country with an inital under-five mortality level of more than 200 deaths per 1,000 that has achieved an average rate of reduction of more than 4.3 percent, the rate required to bring about a two-thirds reduction over a period of 25 years. This is not to say that it is not possible; it simply seems to be more of a challenge.

3 Theoretical considerations and empirical model

In the recent past, some illustrative theoretical models have been proposed in the literature that demonstrate what kind of setting would result in an s-shaped transition path towards high achievements in an indicator of human development. These models are usually based on the assumption of log-logistically distributed incomes, direct costs, or both. Clemens [2004] bases his analysis of the education transition on a simple version of the standard Beckerian model of human development, in which parents weigh the present value of their child's consequent lifetime wage increment against the direct and indirect costs of schooling. Logistic growth comes about as a result of log-logistically distributed future income and current costs of schooling. Lay [2010] makes a similar point assuming that current incomes are log-logistically distributed, which, in turn, determine up-take of social services. The main intuition behind these models is that, initially, only the most well-off individuals will have access to these services. As incomes grow at a (roughly) constant rate across the income distribution, the share of households with access will increase at a faster rate. At this stage, the population share that gains access in each period will increase over time as middle- and lower middle class households gain access. After half the population is covered, the share added to those with access will start decreasing again. Finally, it becomes increasingly difficult to make further inroads as only the poorest members of society lack access. To give a specific example of this kind of model we consider here the case of child mortality.

Assume that a child's probability to die before before age five depends on receiving a particular treatment. For example, this could be a vaccine or safe drinking water. To fix ideas, think of a vaccine. The child will die with probability $\overline{mr}$ if it is not vaccinated. If it gets the vaccine, its odds of dying are assumed to be (close to) zero. Let A parents have access to the treatment at cost C and let log family income be y (for simplicity, we will assume that there is one child per household). We assume that y is logistically distributed across families with mean $\overline{y_t}$ and variance

σ_y^2.[3] We can therefore write

$$y_t = \overline{y_t} + \epsilon, \tag{1}$$

where the family-specific error term, $\epsilon \sim \mathcal{L}(0, \sigma_y^2)$. Now, assume that the net benefit of having one's child vaccinated will be positive if the costs are less or equal to a fraction S of family income.[4] Thus, a child's probability of receiving the vaccine is given by $P(c \leq s + y_t)$, where lower case letters denote logs of the variables. Rearranging and substituting using (1) yields $P(c \leq s + \overline{y_t} + \epsilon) = P(\epsilon > c - s - \overline{y_t}) = 1 - P(\epsilon \leq c - s - \overline{y_t})$. By the law of large numbers, the under-five mortality rate at time t is given by $mr_t = \overline{mr} \cdot P(\epsilon \leq c - s - \overline{y_t}) = \overline{mr} \cdot F(c - s - \overline{y_t})$, where $F(x) = (1 + e^{-(x/\sigma_y)})^{-1}$ is the cumulative distribution function of the logistic distribution. Substituting the expression for $F(\cdot)$ into the above equation yields

$$mr_t = \overline{mr} \cdot (1 + e^{(\overline{y_t} + s - c)/\sigma_y})^{-1}. \tag{2}$$

If per family income in this economy grows exponentially at rate γ, log incomes will be a linear function of time:

$$\overline{y_t} = y_0 + \gamma t, \tag{3}$$

where y_0 is a country-specific starting point. Plugging (3) into the mortality rate equation (2) we get

$$mr_t = \overline{mr}(1 + e^{-\beta(t-a)})^{-1}, \tag{4}$$

where $a = (y_0 + s - c)/\sigma_y$ and $\beta = -\gamma/\sigma_y$. This expression is recognized as the three parameter-logistic function with parameters $\overline{mr}$, a, and β. Note that β is negative as mortality decreases over

[3] Empirically, the log-logistic distribution is often found to yield a fairly good approximation to income data and is widely used in applied empirical work (e.g. Bourguignon [2003] and Klasen and Misselhorn [2008]).

[4] We can think of a quasi-linear utility function in which case a consumption good is consumed until the marginal utility of consuming more falls below the utility of purchasing the medical treatment.

time.

As for the characteristics of the logistic function, note that

$$\dot{mr}_t = \beta \cdot \left(mr_t - \frac{mr_t^2}{\overline{mr}} \right) \tag{5}$$

and thus

$$\frac{\dot{mr}_t}{mr_t} = \beta \cdot \left(1 - \frac{mr_t}{\overline{mr}} \right), \tag{6}$$

where the dot denotes the derivative with respect to time.[5] mr_t therefore changes at rate β for $mr_t \to 0$ and at rate zero for $mr_t \to \overline{mr}$. It is easy to show that if mortality is a decreasing function of time (i.e. $\beta < 0$), $\ddot{mr}_t$ is negative for $t < a$ and positive thereafter. It can also be shown that the function is symmetric around its point of inflection $t = a$. A country will have reduced mortality to $\overline{mr}/2$ at time $t = a$. According to (5), absolute reductions in mortality will first increase and then decrease after the country has achieved the half-way mark. Thus, the logistic growth curve captures the dependence of rates of reduction on initial values.

While this model explains why the transition towards low levels of under-five mortaltiy would follow a logistic growth path, it has obvious limitations. First, in this model, progress in reducing under-five mortality is a consequence of economic growth. Several recent contributions have argued that while there is a role for economic growth in bringing down rates of mortality and improving health in general [Pritchett and Summers, 1996, Fogel, 2004], growth is often found to be trumped by other factors, in particular technological change and maternal education (through improving the efficiency of inexpensive and readily-available technologies) [Easterly, 1999, Hanmer et al., 2003, Deaton, 2004, Jamison, 2006, Kenny, 2009].[6]

It should also be noted that the model makes two other important predictions: first, note that

[5] At first sight, this prediction does not seem to be in line with the left panel of figure 1 since absolute changes do not seem to follow a quadratic function. However, as we will argue below, most countries are likely to have already passed the halfway mark on their way to low levels of mortality so that absolute changes are infact highest for lagging countries.

[6] While nearly all studies find a strong relationship between *levels* of income per capita and indicators of overall health like mortality and life expectancy [e.g. Preston, 1975], the association between *changes* in these variables is often found to be much weaker [Pritchett and Summers, 1996, Easterly, 1999, Kenny, 2009].

the speed of transition β is an inverse function of income inequality measured by the standard deviation of log per unit income. We would therefore expect to see slower transitions in countries with higher income inequality, a prediction that we will test in section 6. Second, the model implies that within-country inequalities in health outcomes will follow an 'inverted U' as in Oster [2009]—inequality will increase as the most privileged parts of society gain access to services such as health care and education and later decreases after half of the population has gained access.

In this application, $\overline{mr}$ is a normalizing constant which can be interpreted as the highest conceivable mortality rate.[7] It might be choosen on the basis of historical experience. The highest under-five mortality rate in the data is reported for Mali at 417.9 deaths per 1,000 in 1965. However, mortality was probably higher than that prior to the onset of the international epidemiological transition which led to a rapid decline in mortality in developing countries after 1940.[8] An alternative would be to estimate $\overline{mr}$ from the relationship depicted in the right panel of figure 1. We fix $\overline{mr}$ at 488 deaths per 1,000 as that is the point at which the regression line in figure 1 intersects with the abscissa.

Since we have panel data, we need to account for different average mortality rates for countries. We can do so by introducing a country-specific point of inflection a_i for country i:

$$mr_{it} = \overline{mr}(1 + e^{-\beta(t-a_i)})^{-1}. \tag{7}$$

Rearranging and taking logs yields

$$-\ln\left(\frac{1}{mr^*_{it}} - 1\right) = \beta(t - a_i), \tag{8}$$

where $mr^*_{it} = {}^{mr_{it}}/_{\overline{mr}}$. Note that at this point we loose all country-year observations for which $mr_{it} \geq \overline{mr}$, a minor problem in this case as explained above. Thus, the normalized and transformed

[7] Alternatively, $1 - \overline{mr}$ can be interpreted as the 'natural' survival rate, i.e. the survival rate absent any medical interventions.

[8] Most of this decline was driven by the rapid spread of new technologies and practices. See Stolnitz [1965].

indicator can be estimated by

$$-\ln\left(\frac{1}{mr^*_{it}} - 1\right) = \alpha_i + \beta t + \epsilon_{it}, \tag{9}$$

where $\alpha_i = -\beta \cdot a_i$ is a country-fixed effect and ϵ_{it} is the usual error term.

Our goal here is to estimate the average transition speed in order to use it as a yardstick against which progress can be measurend. Thus, we do not allow the speed of transition β to vary across countries. If one's goal was to specifiy the model to best fit the data, one could allow for region- or even country-specific transition speeds, whenever there are enough observations per country. In that case we could interact t with the appropriate dummy variables to obtain an estimate of a country's transition speed. However, since we are interested in estimating an 'average' transition speed, we stick to this model as simple as it may be.

4 Estimating transition paths

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4.1 The mortality transition

4.1.1 Data and estimation

To estimate transition paths for under-five mortality, we rely on data from the WDI 2011 database. For some countries (presumably those with vital registration systems) under-five mortality is reported anually even prior to 2005. However, using these additional observations might bias our results towards the transition speed of the group with more frequent data reporting. We therefore eliminate in-between observations and use only observations for 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005, and 2009. Data coverage increases over time from 101 observations in 1960 to 117, 139, 158, 175, 186, and then 191 observations in 1990. Finally, for 1995, 2000, 2005, and 2009 we have observations for 192 countries. Thus, selection effects are negligible if we only consider the last two decades.

In table 1 we report results for estimating equation (9) via OLS using the transformed data for under-five mortality as the dependent variable for different samples. Since imposing a constant speed of transition introduces within-group serial correlation, all standard errors reported in table 1 are clustered around the country-identifier.

Table 1: Fixed effects-estimates for under-five mortality

	(1)	(2)	(3)	(4)
Dep. variable:	$-\ln(1/u5mr^*_{it}-1)$			
	All	LICs & MICs		DHS data
	1960–2009	1960–2009	1990–2009	1985–2010
t	-0.041^{***}	-0.039^{***}	-0.037^{***}	-0.035^{***}
	(0.001)	(0.001)	(0.002)	(0.005)
R^2	0.96	0.94	0.98	0.99
Within-R^2	0.83	0.81	0.69	0.59
Obs.	1,835	1,358	705	186
No. of groups	192	141	141	55

Notes: Clustered standard errors in parentheses. *, **, and *** denote significance at the ten-, five-, and one-percent level, respectively.

The first column in table 1 reports results for the entire dataset as described above. The estimated transition speed (the coefficient on t) is highly significant and implies an at-the-limit rate of reduction of 4.1 percent per annum, slightly lower than the rate of reduction required to meet MDG4. This is not to say that countries cannot reduce mortality at a higher speed as this is just an 'on average' statement. However, it should also be noted that this is the speed of reduction that countries tend to on average as the mortality rate tends to zero. As is typical for fixed-effects models, the R^2 is quite high, implying that the the model explains 96 percent of the overall variation in the data. What is more important is the within-R^2: despite the simplicity of the model with years as the single time-varying predictor, it explains about 82 percent of the within-country variation in the transformed data.

In addition, we can also inspect the fit of the model visually by calculating what Clemens [2004] refers to as *adjusted years*. This is the difference between the year of the datapoints and $\hat{\alpha}_i/\hat{\beta}$. In effect, we re-adjust all datapoints so that all individual transition paths pass through $\overline{mr}/2$ in adjusted year zero. The resulting scatter plot and our estimate of the transition path estimated in column (1) of table 1 are given in figure 2.

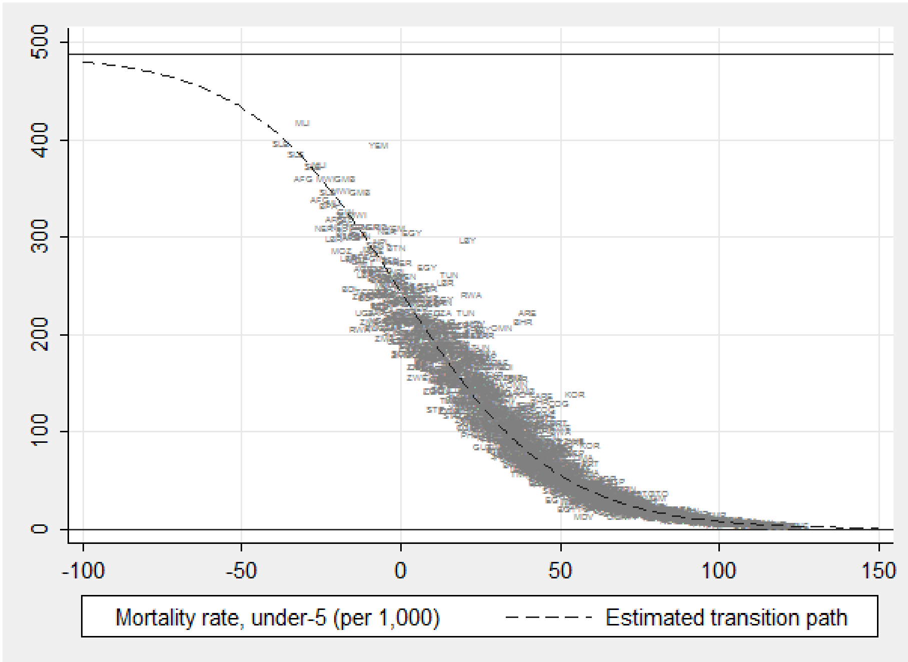

Figure 2: Under-five mortality rates (per 1,000 live births), 1960–2009, against adjusted years and fitted transition path. Based on WDI 2010 data.

Column (2) reports results for the subsample of low and middle income countries (LICs & MICs) as defined by the World Bank using data for all years available. The coefficient on t is only marginally smaller in absolute terms. In column (3) we restrict the sample size further to include only observations for the 1990–2009 subperiod. As pointed out before, selection effects should be of no concern for this particular subsample. Again, the coefficient remains virtually unchanged. We conclude that the transition path model is fairly general.

As discussed, data on under-five mortality are available with broad country and time coverage, limiting the degree to which selection-bias might affect our results. On the other hand, the data reported are only estimates, the foundations for which might be weak in some cases.[9] Thus, one

[9] For a review and discussion of the method used to estimate under-five mortality rates, see Silverwood and Cousens [2008].

might suspect that the good fit of the model is in fact due to some particular feature of the method used to construct the data set.

To check for the robustness of these results we therefore turn to estimates of under-five mortality derived from Demographic and Health Surveys (DHS) and Reproductive Health Surveys (RHS), which can be accessed through the MEASURE DHS webpage (www.measuredhs.com). The statistics are based on representative household surveys and should therefore not be subject to bias resulting from features of the estimation procedure. If a survey was conducted over two successive years, we attribute results to the first year. The drawback here is that coverage is less comprehensive. Overall, there are 55 countries in which more than two surveys have been conducted between 1985 and 2010 for a total of 186 observations.

Results from using DHS data are reported in column (4) of table 1. Note that the DHS data cover developing countries for the 1985–2010 period. Thus, the estimate of the transition speed should be compared to that in column (3). We find a marginally lower estimate on t in absolute terms while at the same time the standard error is about two and a half-times as large, due to the small sample size. The fit of the model is still very good as indicated by a within-R^2 of 0.59. Figure 3 plots actual observations from this data set against adjusted years.

4.1.2 Discussion

Three things should be noted: first, the estimated transition path is fairly general. In particular, the coefficient on t is not sensitive to the development status of the countries in the sample; it does not matter whether we consider all countries for which data are available or just the subset of LICs and MICs. Also, the explained within-group variation remains high.

Second, it should be noted that while the model describes changes over time with reasonable precision, it is silent on when exactly a country embarks on this transition path. The timing of the onset of demographic transitions has been discussed at length elsewhere (e.g. Reher [2004]). What we argue is that once countries have embarked on a mortality transition, progress tends to be remarkably uniform.

Finally, those involved with international goal-setting should concede that progress takes time—

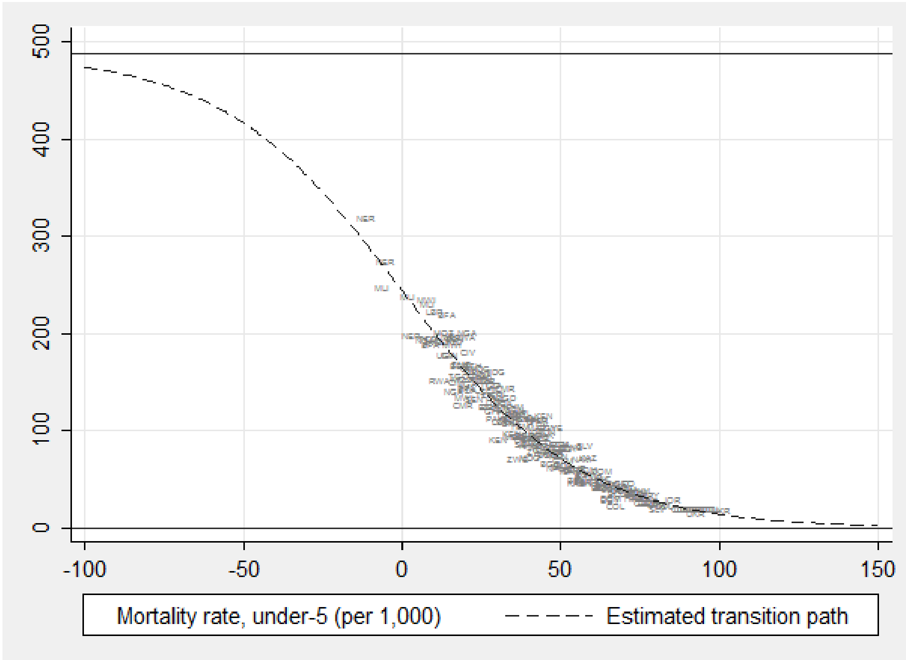

Figure 3: Under-five mortality rates (per 1,000 live births), 1985–2010, against adjusted years and fitted transition path. Based on DHS data.

in most cases more time than the current MDG framework allows for. To further investigate the implications of these estimates for the MDG4 target, we can do a back-of-the-envelope calculation to arrive at the projected time needed for a reduction in under-five mortality by two thirds. Inverting (4) yields

$$t_{mr_t} = \frac{(\ln(\overline{mr}/mr_t) - 1)}{\beta} - a. \tag{10}$$

It is straightforward to then calculate

$$t_{mr_{t/3}} - t_{mr_t} = \frac{\ln(\frac{\overline{mr} - mr_t}{3 \cdot \overline{mr} - mr_t})}{\beta}, \tag{11}$$

which gives us the expected time to accomplish a two-thirds reduction in under-five mortality as a function of the initial level.

This function is depicted in figure 4. It shows that the lower a country's initial level of under-five mortality, the more likely it is to attain MDG4. The highest under-five mortality rate reported for 1990 is Niger's with slightly more than 300 deaths per 1,000. These estimates predict that it will take such a country about 45–50 years to meet the numerical MDG3 target. However, even countries with low levels of under-five mortality will, on average, still need about 25–30 years to bring about a reduction by two-thirds. This is analogue to our finding that the average rate of reduction tends to the coefficients reported in table 1, which is somewhat lower than the rate of reduction required to meet the target. Hence, most countries will not meet the target: while it is challenging for countries starting with low inital levels under-five mortality, it is unrealistic for countries starting with high initial levels.

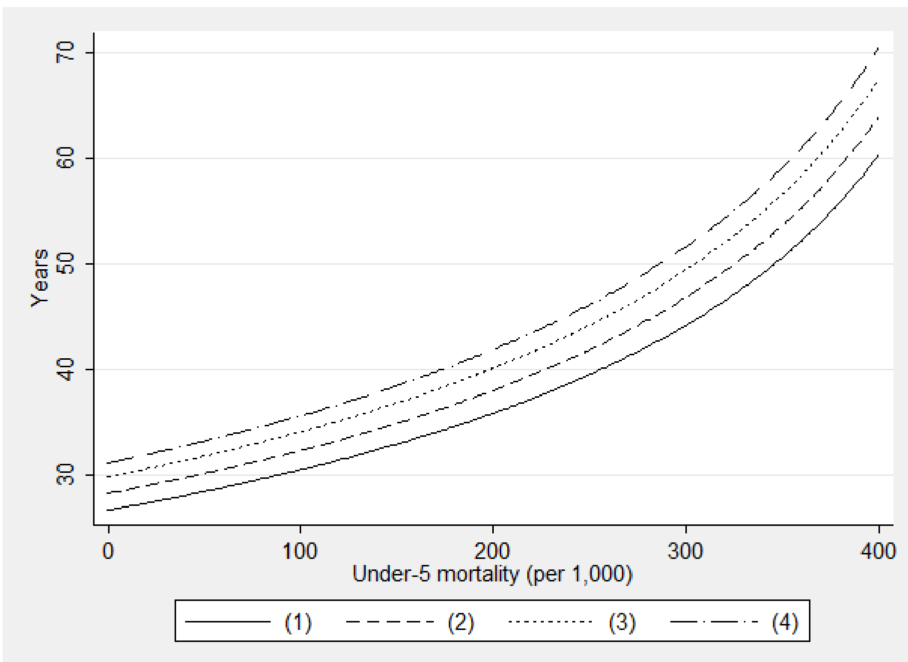

Figure 4: Estimated time to attain MDG4 (two-thirds reduction in under-five mortality) against initial level. The four lines refer to estimates in table 1.

4.2 The education transition

4.2.1 Data issues

In principle, the same kind of estimation can be done for education data such as the primary completion rate (the preferred indicator for MDG2) and even for the gender ratio in education [see Clemens, 2004].[10] However, several shortcomings of the official indicators for MDG2 and MDG3 need to be noted:

First, while mortality rates are clearly outcome measures, completion or enrollment rates are outputs that do not actually tell us anything about the quality of education [see Filmer et al., 2006]. One could move on to literacy rates (also an official MDG indicator), but data availability is just as poor and the way literacy is assessed in surveys is far from consistent (ibid.).

Second, the *ratio* of girls to boys in primary and secondary education is probably not the best measure to assess gender disparities in education. After all, it is easy to think of situations in which hardly anyone is actually enrolled but the gender ratio signals large disparities. An alternative would be to consider the *gap*, i.e., the difference between attainment rates. This indicator might trace out an inverted-U shape with increasing inequality (boys are likely to have access to schooling first) and decreasing inequality as most boys are already enrolled and more and more girls finally gain access [see Oster, 2009].

Third, the official MDG indicator to monitor progress towards gender equality in education, the ratio of girls to boys in primary and secondary education, implicitly includes the well-known problem of biased sex-ratios at birth and during childhood [see Abu-Ghaida and Klasen, 2004]. Even though this is without doubt an important issue, we believe that it should be dealt with explicitly rather than implicitly. To circumvent this problem one could use the ratio of gross enrollment rates as in Abu-Ghaida and Klasen [2004] and Clemens [2004].[11]

Moreover, there are several data-related problems that make estimating transition paths partic-

[10] Clemens [2004] considers log-logistcally distributed wages and costs of schooling, which lead to logistic growth towards high levels of enrollment in a Beckerian model. He also shows that if costs are higher for girls, the ratio of girls to boys follows a logistic growth path as well.

[11] Gross enrollment rates are calculated by dividing the number of all children enrolled in secondary education divided by the population in that age bracket.

ularly difficult:

- **The 'upper bound' problem** Conceptually, the primary completion rate is the proportion of children that graduates from primary school in the relevant age bracket. Thus, it should not exceed 100 percent. However, it is proxied by the total number of students in the last grade of primary school minus the number of repeaters in that grade divided by the total number of children of official graduation age. Due to late enrollment (and possibly measurement error), our series includes in total 470 observations above 100 percent—almost 20 percent of all country-year observations.[12] Therefore, one faces a trade-off between including as many observations as possible and choosing a plausible upper bound for the transition path.[13]

  This problem is also endemic for the official indicator for MDG3, the gender ratio in primary and secondary education, and alternatives like the ratio of gross enrollment rates in secondary education. Almost 48 percent of countries report a ratio of gross enrollment rates larger than one (about 13 percent report a ratio larger 1.1). However, taking the ratio of girls' gross enrollment rates to boys' might attenuate measurement error if the series's errors for a given country-year observation are positively correlated.

- **Unbalanced series and missing observations** While the mortality data are close to a balanced panel with 8–10 observations per country, educational attainment data is highly unbalanced and, since data is not missing randomly, results will be driven by those countries with more frequent data reporting.

  In order to make projections one would also like to have observations for two points in time for each country—in our case for 1990 and 2008—in order to make projections based on estimated transition paths and compare these to actual performance. Instead, one has to rely on near-by observations as outlined below which makes comparison between countries more difficult.

[12]Moreover, the primary completion rate is biased upward as not all children enrolled in the last grade of primary school actually graduate.

[13]Alternatively, one could estimate transtition paths using data on net primary enrollment as in Clemens [2004] and Lay [2010]. However, data availability is poor for this indicator. For example, India reports data for net primary enrollment only from 2000 onward, while China reports data only for the 1990–1997 period. Thus, we cannot compare performance towards MDG2 for the 1990–2008 period for these two countries based on this indicator.

- **The 'relevance' problem** The relevance of MDG2 and MDG3 differs between developing countries. While mortality rates can still be considered high compared to developed countries in almost every developing country, universal primary completion and the elimination in the gender gap in education are MDGs that have been attained in many developing countries, particularly in East Asia, Latin America, and the transition economies. For countries as diverse as Bulgaria, China, Cuba, Indonesia, Jamaica, Jordan, Sri Lanka, Mauritius, Poland, and Romania previous policy efforts have resulted in a primary completion rate of more than 95 percent by 1990. How should these countries be dealt with when comparing progress across countries? More practically, there is no point in relying on observations for these countries for the estimation of transition paths.

  The problem is illustrated in figure 5, where we compare the cross-country distribution of secondary enrollment ratios across time (censored at 1.1). While the distribution was fairly spread out in 1970, more and more lagging countries managed to catch up over time.[14]

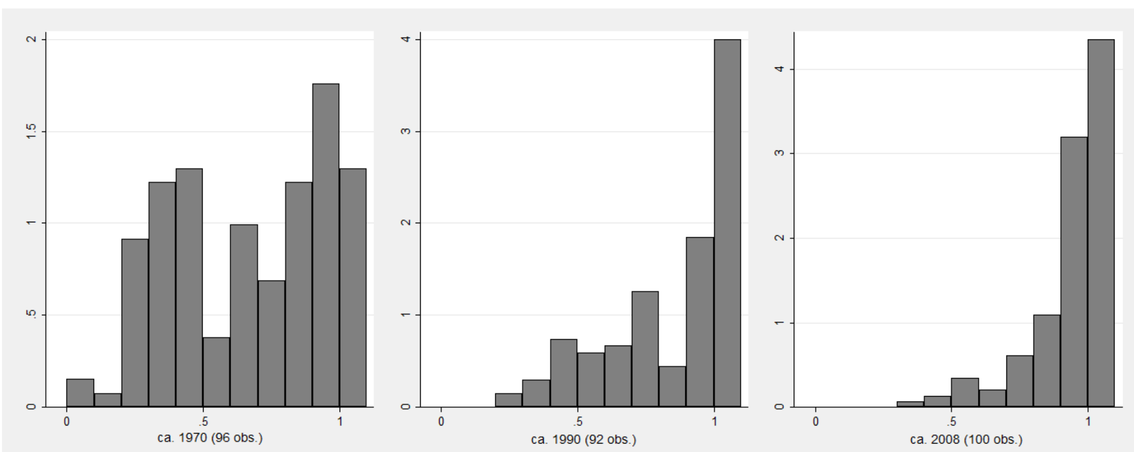

Figure 5: Histograms of the gender ratio in secondary education, 1970, 1990, and 2008 (or nearest observation).

To summarize, the data we have are not the data we want, the data we want are not the data we need, and the data we need are simply not available. Keeping these caveats in mind, we demonstrate

[14]The dissolvement of the former Soviet Union after 1990 added some countries with gender ratios around unity, but the picture looks similar if those countries are excluded.

that transition towards high achievements on MDG2 and MDG3 apply in general. We use data on primary completion rates and the ratio of gross enrollment rates for the 1970–2009 period (both taken from the World Development Indicators 2010) rather than net enrollment rates and the ratio of girls to boys in education.

For the estimation we choose cut-offs of 105 percent for the primary completion rate and a value of 1.1 for the ratio of gross enrollment rates, which leaves us with 93 and 87 percent of the original country-year observations, respectively. Also, for the two series there are few occasions in which values of zero are reported: Lesotho (1970) and Rwanda (1985, 1990, and 1991) for primary completion and Afghanistan (2001) for the enrollment ratio. Clearly, the assumption is that because of military conflicts no child, respectively no girl went to school. These country-year observations are dropped from the dataset.

4.2.2 Estimation and results

Results for estimating equation (9) via OLS for all countries (columns 1 and 4), for LICs and MICs seperately (columns 2 and 5) and, for the latter subsample, for the subperiod 1990–2009 (columns 3 and 6) are reported in table 2. First, focus on columns 1 and 2. Comparing the estimated (maximum) transition speeds, we find that they are insensitive to countries' level of development. These estimates, 4.2 for all countries and 4.5 percent for LICs and MICs, are only marginally higher than those reported by Clemens [2004] who analyzes net primary enrollment over the 1960–2000 period. Results imply that it takes the average country more than 30 years to increase the primary completion rate from 20 to 80 percent.

The coefficient is estimated with a 50 percent larger standard error if only observations for 1990–2009 period are considered. This is mainly due to the relevance problem and only partly owed to the smaller sample size. Since many countries were already close to a primary completion rate of 100 percent by 1990, there is less within-country variation over the following years. Since identification of the parameters is based solely on within-country variation, the precision of the estimates decreases.

For the gender ratio in secondary education, results are similar. Based on the estimated coeffi-

Table 2: Fixed effects-estimates for education transitions

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variable:	$-\ln(1/compl^*_{it} - 1)$			$-\ln(1/ratio^*_{it} - 1)$		
	All	LICs & MICs		All	LICs & MICs	
	1970–2009	1970–2009	1990–2009	1970–2009	1970–2009	1990–2009
t	0.042***	0.045***	0.056***	0.035***	0.041***	0.026***
	(0.004)	(0.004)	(0.006)	(0.003)	(0.004)	(0.007)
R^2	0.81	0.83	0.85	0.93	0.92	0.94
Within-R^2	0.21	0.28	0.19	0.23	0.31	0.06
Obs.	2,187	1,619	1,394	2,565	1,742	1,414
No. of groups	183	133	132	187	133	130

Notes: Clustered standard errors in parentheses. *, **, and *** denote significance at the ten-, five-, and one-percent level, respectively.

cients using all country-year observations it takes between 30 and 40 years to lift the gender ratio from one girl for every five boys to four girls. The fit seems to be marginally better at least if the entire time period is considered. Estimates are lower than those reported by Clemens [2004] who uses the same indicator but a slightly different time period. However, if only the last two decades are considered, the coefficient drops to 2.6 percent (implying that it takes more than 50 years to get from a gender ratio of 1:5 to 4:5). Again, the standard error of the coefficient on t is about 50 percent larger if only the 1990–2009 subperiod is considered and the within-R^2 drops to a dismal 6 percent.

Figures 6 and 7 show the respective transition paths based on the estimates in columns 1 and 4 of table 2 against adjusted years. While these figures and the within-R^2-statistics reported in table 2 indicate that the fit of the models are not quite as good as in the case of the mortality series, we find that countries are generally following the s-shaped transition path.

5 Judging progress using performance indices

The previous sections show that, even though each country has its own circumstance, it is still meaningful to speak of *the* mortality transition and *the* education transition as Clemens [2004] puts it. Development takes time and expected improvements in the future depend crucially on the point at which a country is located on the trajectory of the transition path. At the same time, we have demonstrated that countries tend to follow a remarkably uniform transition path once they

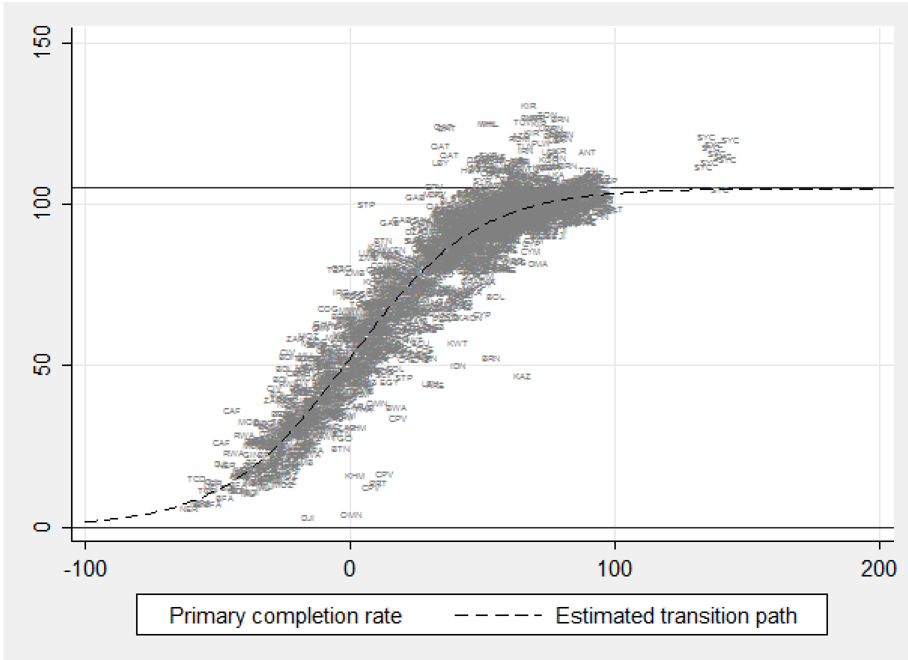

Figure 6: Primary completion rates, 1970–2009, against adjusted years and fitted transition path.

have embarked on the transition path and given this result. Hence, it is only consequent to judge countries' progress relative to expected progress (based on past experience). In this section, we do so by calculating *performance indices* for the post-1990 period since 1990 is the baseline year for the numerical targets of the MDGs. We then go on to compare our performance index to the performance measure implicitly defined by the numerical target within the MDG framework, the relative rate of reduction in under-five mortality.

In the case of under-five mortality rates, let $\widehat{mrc}_{t+\tau} = \widehat{mrc}_{t+\tau}(mrc_t, \tau, \beta)$ be the predictor function in the sense that if we observe mrc_t at time t, we expect to observe $\widehat{mrc}_{t+\tau}$ at time $t + \tau$ based on transition speed β:

$$\widehat{mrc}_{t+\tau} = \overline{mrc}\left(1 + \frac{\overline{mrc} - mrc_t}{e^{\beta\tau} mrc_t}\right)^{-1} \tag{12}$$

The performance index for country i is then defined as the ratio of actual changes to expected

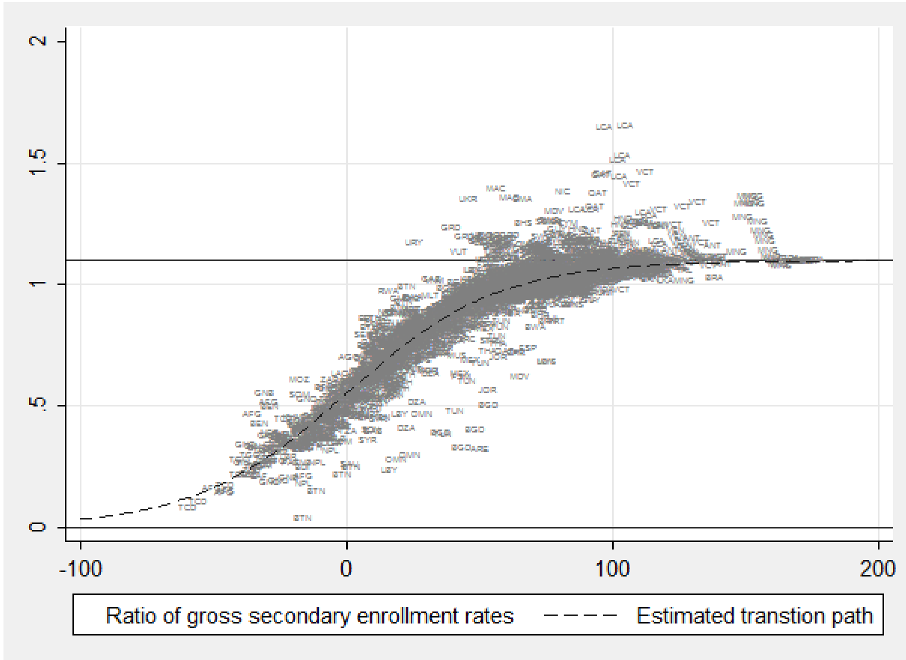

Figure 7: Ratio of male to female gross enrollment rate in secondary education, 1970–2009, against adjusted years and fitted transition path. (One observation for Nicaragua (1985) was dropped from the figure as it was larger than 2.)

changes based on the estimated transition path with speed β:[15]

$$pi_i = \frac{mrc_{i2009} - mrc_{i1990}}{\widehat{mrc}_{2009}(mrc_{1990}, 19, \beta) - mrc_{i1990}}. \tag{13}$$

A performance index larger than unity indicates overperformance, unity indicates average progress, and an index less than unity indates underperformance. Since our estimates of the transition speed do not differ too much across different samples, we choose the respective βs from the estimations using all observations, that is, the transition speed reported in column 1 in table 1 in the case of the mortality transition and from columns 1 and 4 of table 2 for primary completion and the gender ratio, respectively.

[15]Note that comparing actual relative changes to predicted relative changes would yield the same result as the denominator for both is identical.

5.1 Under-five mortality (MDG4)

Since MDG4 is defined as a relative reduction, the performance index has to be compared to the average annual rate of reduction. First, both indicators, the performance index and the average annual rate of reduction, are highly correlated (the correlation coefficient is 0.93, significant at the one-percent level). This comes as no surprise given that both indicators share the same numerator. However, in comparison with the annual rate of reduction, the main advantage of the performance index is that it does not depend on initial levels. The slope parameter of the regression line in figure 8 is not significant at convential levels. Thus, the performance index does not discriminate against countries with higher initial mortality.

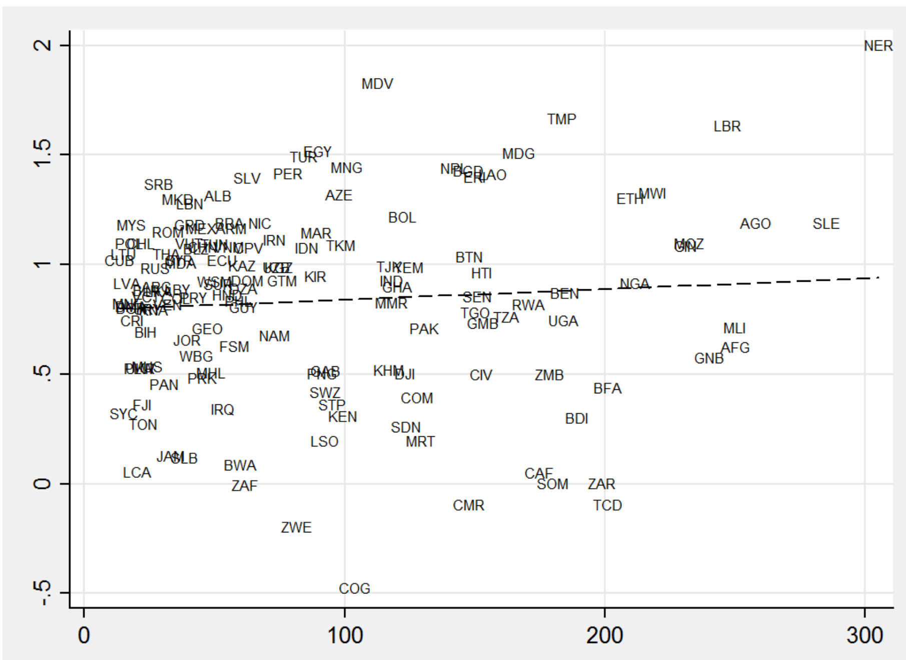

Figure 8: Performance index for under-five mortality against initial levels and fitted regression line, for 141 LICs & MICs, 1990–2009.

Figure 9 plots the annual rate of reduction against the performance index. The quadrants indicate whether a country is classified as a 'good performer' according to the criteria used. An annual rate of reduction larger than 4.3 percent qualifies to be classified as 'on-track' to meet MDG4.

A performance index in excess of unity signals ‘overperformance’ according to our criterion. First, only 38 percent of the 141 developing countries considered in this analysis have achieved the average annual rate of reduction requried to achieve a reduction by two-thirds over 25 years. At the same time, 57 countries have managed to outperform the past trend according to the performance index.

Note that no country is classified as being on-track that is not at the same time classified as an overperformer. While only one Sub-Saharan country, the Cape Verde Islands, can be counted as being on-track to meet MDG4 by 2015, there are several countries in Sub-Sahara Africa that have outperformed average progress in the past. These include seven countries in Sub-Sahara Africa (Ethiopia, Malawi, Mozambique, Angola, Guinea, Liberia, and Niger), two countries from the MENA region (Syria and Yemen), one country each from South Asia, Southeast Asia, and Latin America (Bhutan, Indonesia, and Ecuador), and six countries from Eastern Europe and Central Asia (Kazakhstan, Kyrgyz Republic, Moldova, Russia, Turkmenistan, and Uzbekistan). It is noteworhty that the latter group had mortality levels not higher than 100, while all countries in Sub-Sahara Africa had mortality rates in excess of 200. Moreover, the latter have outperformed the trend only mildly, with performance indices ranging from 1.01 (Uzbekistan) to 1.04 (Moldova). In Sub-Sahara Africa, on the other hand, some countries have achieved performance indices as high as 1.54 or 1.47 (Niger and Malawi, respectively). At the same time, only one Sub-Saharan African country, the Cape Verde Islands, has managed to cut under-five mortality by the required 4.3 percent per year. This is also one of the countries with the lowest initial mortality rate. This difference reflects the fact that the discrepancy between what is required to meet MDG4 and what high-mortality countries have achieved in the past becomes increasingly large.

Even though some African countries are clearly overperformers, the region as a whole is still found to be lagging in terms of progress towards MDG4. Table 3 reports population-weighted averages of initial levels, the average annual rate of reduction and performance indices. Clearly, Sub-Sahara Africa trails behind in terms of progress towards MDG4 and so does the Oceania region. Severe underperformers in Sub-Sahara Africa include countries affected by the HIV/AIDS epidemic that coincides with the episode under study, some of which had low levels of under-five mortality in 1990 in comparison to the regional average: South Africa, Botswana, Lesotho, and Zimbabwe.

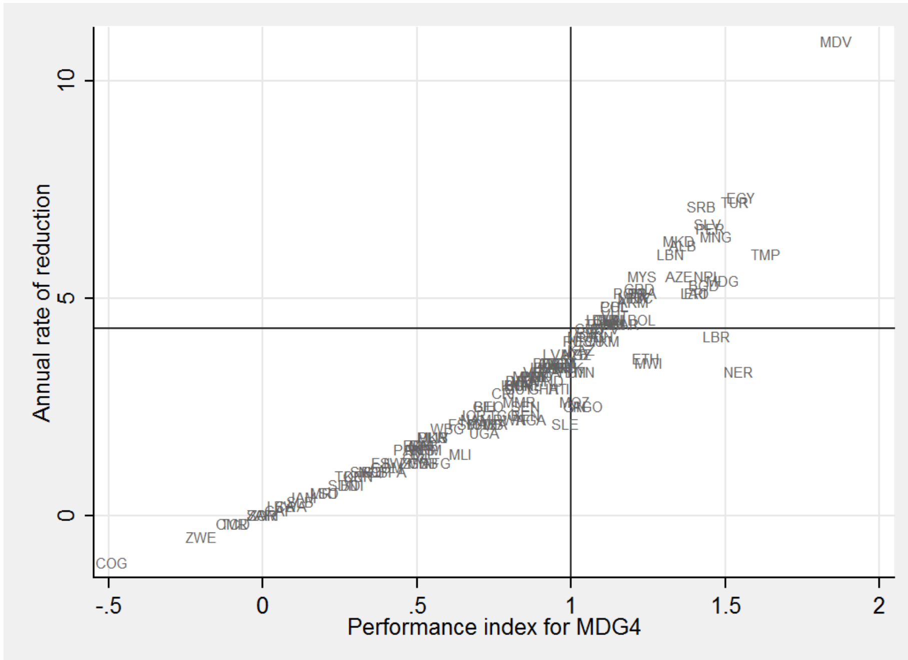

Figure 9: Annual rate of reduction against performance index for under-five mortality for 141 LICs & MICs, 1990–2009. Countries classified as 'Overperformers' are located to the right of the vertical line. Countries 'on-track' for a two-thirds reduction in under-five mortality are located above the horizontal line.

Others are 'failed states' such as Chad, the Congos, the Central African Republic, and Somalia.

For the under-five mortality series it is also possible calculate performance indices for the two decades seperately. The last two columns in table 3 reports population-weighted averages for the 1990-2000 and 2000–2009 sub-periods. These figures support conventional wisdom. In particular, Africas performance in the 1990s, a decade often refered to as the continent's 'lost decade', is reflected in these numbers.

In summary, using the performance index rather than the annual rate of reduction does not make much of a difference when comparing progress at the regional level. But it does make a difference for individual countries, particularly those with high initial levels of under-five mortality. Criticism where criticism is due; praise where praise is due.

Table 3: Initial levels of under-five mortality, average annual rate of reduction, and performance indices by region, 1990–2009

Region	No.	Initial level 1990	Average annual rate of reduction	Performance Index 1990–2009	1990–2000	2000–2009
West & Central Africa	20	152.4	2.0	0.69	0.37	1.00
South & East Africa	27	192.0	1.5	0.59	0.39	0.79
Middle East & North Africa	12	73.9	4.6	1.13	1.16	1.23
South Asia (excl. India)	7	140.0	3.7	1.06	1.06	1.14
India		118.2	3.1	0.94	0.77	1.09
East Asia (excl. China)	11	70.9	3.8	1.02	1.10	0.91
China		45.5	4.5	1.12	0.66	1.60
Oceania	10	75.1	1.6	0.51	0.55	0.39
Latin America	19	49.4	4.6	1.14	1.17	1.18
Caribbean	10	63.5	3.4	0.92	1.01	0.82
Eastern Europe & Central Asia	23	40.4	4.3	1.06	0.77	1.36

Notes: Population weights based on 1990 populations.

5.2 Primary completion (MDG2) and gender ratio in education (MDG3)

Forewarned of the problems outlined in section 4.2.1, we also calculate performance indices for the primary completion rate and the gender ratio in secondary education over the 1990–2009 period. In this case, our strategy has to be modified slightly: we first identify the year closest to 1990 (+/− 6 years) and the last year for which a data point is available for each country (see tables 7 and 8 in the appendix). We then compute absolute and projected changes over this time period country-by-country and use these to derive our performance indices as above.

As an illustration of the distribution of this performance indices across initial levels, figure 10 plots the performance index for primary completion against initial levels for 72 LICs & MICs. Here, we only consider countries for which MDG2 is still relevant, i.e. we only consider countries for which the initial primary completion rate is less than 90 percent.

Again, we see that there is no significant relationship between initial primary completion rate and subsequent performance. Mali, Bhutan, and Ethiopia have achieved outstanding increases in primary completion, out-performing average progress by a factor greater than four. Note also that the variance of the performance index increases with increasing inital levels. This is a manifestiation of the ‘upper bound’ problem discussed in section 4.2.1: as countries get closer to universal primary education at the outset of the period for which the performance index is calculated, the index becomes more and more unstable as the denominator approaches zero.

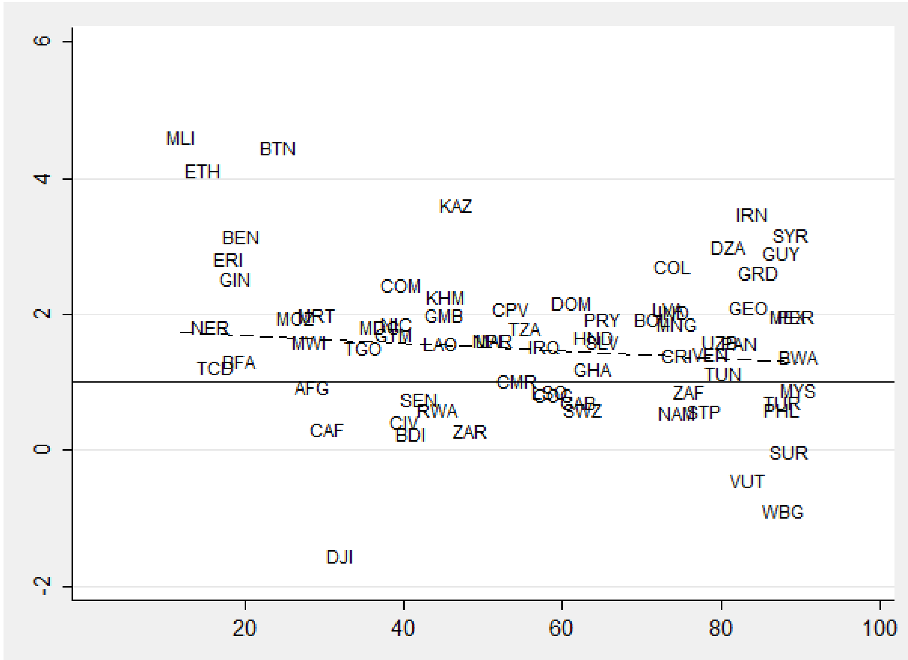

Figure 10: Performance index for primary completion against initial levels and fitted regression line, for 72 LICs & MICs, c. 1990–2009.

Table 7 and table 8 in the appendix compare initial rates, to actual and projected rates for primary completion and the gender ratio in secondary education. Following our argumentation above, projected rates can be interpreted as realistic targets. In both regions we find both over- and underperformers. With only about between six and ten years to go, most of these countries are very unlikely to attain the education MDGs by 2015. However, it should be clear from these numbers that even among those countries that are ‘off-track’ there are several which have achieved considerable improvements.

6 Regression analysis

6.1 Data and descriptive statistics

In this section we investigate correlations for our performance indices for the 1990–2009 period using multivariate regression analysis. Before we procede, we would like to note that these regressions cannot necessarily be interpreted as causal relationships with causality running from independent to dependent variables. In most specifications, we are unable to rule out omitted variable problems and reverse causality. However, the following analysis is still helpful as it allows us to check the plausibility of our index as a performance measure.

We estimate the following model:

$$pi_i = \mathbf{X}'\delta + \mu + \nu_i, \tag{14}$$

where pi_i is either *pimrc*, *picompl*, or *piratio*, that is, the performance index for under-five mortality, primary completion, or the gender ratio in secondary education as defined above, $\mathbf{X}'$ is a set of explanatory variables explained below and δ a vector of parameters to be estimated, μ is a complete set of region dummies, and ν_i is an idiosyncratic error term.

$\mathbf{X}'$ includes *growth*, which is the average annual growth rate in GNI per capita (in international dollars) over the 1990–2008 period as reported in the World Development Indicators 2010. An expansion of an economy's production of goods and services has the potential to increase the government's capacity to provide public goods such as health care and education. Moreover, increasing incomes should also be associated with an increase in demand for these goods as well as improved nutrition.[16]

Since it is commonly assumed that parents' education is related to a child's survival probability as well as schooling decisions, we also include measures of the population's average years of education as explanatory variables. $\Delta educm$ and $\Delta educf$ refer to absolute changes in males' and females' average years of education over the 1990–2010 period. The data come from Barro and Lee [2010].

[16] Pritchett and Summers [1996], for example, find that growth in per capita GDP accounts for roughly 40 percent of cross-country differences in mortaltiy improvements.

Several authors have argued that it is mainly the economic status of women which affects health outcomes and education decisions for children positively [e.g. Caldwell, 1986] and empirical evidence for this conjecture is rapidly accumulating.[17] Therefore, we expect at least changes in females' average years of education to be positively correlated with performance. Since there is an obvious correlation between increase in the stock of education and performance towards the MDG education targets over the same time period, we include changes in stock variables over the 1980–2000 period.

$\Delta mepv$ is the change in the intensity of political violence over the 1990–2008 period. The original data come from the updated online version of the Major Episodes of Political Violence dataset [see Marshall, 1999], which ranks the intensity of political violence on a scale from 0 to ten on an annual basis. Clearly, we expect an increase in the intensity of political violence to be negatively associated with performance in all three dimensions. $\Delta urban$ is the change in the population share living in urban areas. A higher urbanization rate might facilitate the provision of basic health care and education services. Thus, one might expect to find positive coefficients on this variable. However, as argued by Cutler et al. [2006], initial urbanization had adverse effects on health in the 19th century in now industrialized countries and—given the level of uncontrolled migration to cities in the developing world—might have similar effects today.

Moreover, we include two variables that are frequently employed in growth regressions. In section 3 we argue that a country's speed of transition is negatively associated with income inequality. We therefore include the Gini index ($gini$) in our regression equation. We expect to find a negative sign on this variable.[18] Alesina et al. [1999] also argued that ethnic divisions account for insufficient provision of public goods such as education. Therefore, we also include the index of ethno-linguistic fractionalization ($frac$) developed by Alesina et al. [2003].[19] Both these variables generally do not show much variation over time so that the exact year the figures are attributed to are of minor importance.

[17] Just how important maternal education is in the context of child health is not yet resolved as it is difficult to disentangle the effect of maternal education from effects of unobserved socio-economic and geographic factors. See Desai and Alva [1998] and Kravdal [2004] for a discussion.

[18] The data come from the WDI 2011 dataset. Since data availability is sparse, we use the observation that is closest to the year 2000.

[19] The index is calculated as the probability to randomly choose two individuals from a given population that belong to the same ethno-linguistic group. [See Alesina et al., 2003] for a discussion of alternative measures.

Finally, two variables are included only if we consider performance towards low levels of under-five mortality. First, Δhiv is the absolute change in HIV prevalence in the adult population (ages 15–49) as reported in UNAIDS [2010]. We expect this variable to have a large negative association with *pimrc*.[20] It would be preferable to use prevalence of HIV among children rather than among adults but the later should be a fairly good proxy for the later. Moreover, HIV prevalence among adults could also have an important effect over and above the increasing risk of infection for children as is often argued in the context of AIDS orphans. Second, Δdpt is the change in the proportion of children aged 12-23 monts that have been immunized against diptheria, pertussis, and tetanus (DPT). Rather than stressing the importance of this particular vaccination, we include this variable because it serves as a proxy for changes in the effectiveness with which the government provides health services. Summary statistics of the variables are reported in table 4.

Table 4: Summary statistics for the analysis of performance indices, c. 1990–2009

Variable	Mean	Std. Dev.	Min	Max	N
Dependent variables					
pimrc	0.84	0.43	−0.49	1.86	141
picompl	1.59	1.12	−1.57	4.59	72
piratio	1.27	1.05	−1.84	4.46	55
Independent variables					
growth	4.28	1.99	−2.10	12.13	114
$\Delta educm_{90-09}$	1.31	1.26	−2.77	4.02	100
$\Delta educf_{90-09}$	1.77	1.19	−1.10	4.74	100
$\Delta educm_{80-00}$	1.38	1.26	−1.52	6.70	100
$\Delta educf_{80-00}$	2.40	1.34	−0.40	6.45	100
$\Delta mepv$	−0.85	2.19	−9.00	5.00	102
Δ *urban*	5.44	5.28	−5.30	17.80	142
gini	0.44	0.09	0.28	0.74	114
frac	0.49	0.25	0.00	0.93	135
Δ *dpt*	0.09	0.18	−0.44	0.60	117
Δ *hiv*	0.02	0.04	−0.04	0.24	106

[20] Since it is impossible to accurately estimate HIV prevalence if is very low, the data will only indicate if the estimate is smaller than 0.1 without stating a more precise figure. In our dataset we replace all those values with zero since a prevalence rate of less than a tenth of a percent is, for all practical purposes, zero.

6.2 Regression results

Regression results are reported in table 5, where we report results from estimating three different specifications of (14) for each index via OLS. As expected, the coefficient on economic growth has a positive sign in all specifications and is significant when either *pimrc* or *picompl* is the dependent variable (columns 1–3 and 4–6). All else equal, an increase in the growth rate by one percentage point is associated with an increase of 0.05–0.06 points in *pimrc*. However, it is possible that there is a spurious relationship between economic growth and reductions in child mortality. In particular, technological change could be driving both variables. Below, we will use a two-way fixed effects model which allows for a common time trend in order to address this problem.

In the case of *picompl*, the coefficient is about four times larger, i.e. an additional percentage point of growth adds about 0.2 points to the performance index. This could imply that enrollment depends primarily on economic prospects. The regression results do not support the hypothesis that economic growth is important for closing the gender gap in education. However, failure to discern a statistically significant relationship could be due to the small sample size on which the results in columns 7–9 are based.

In the case of changes in adults' years of education, we find a positive relationship between changes in females' years of education and *pimrc*, but not between males' years of education and the latter (column 2). This association is also important in terms of economic significance. An additional year of education for women is associated with an increase in *pimrc* of between 0.10 and 0.14 points. However, the coefficient is not significant when more variables are included (column 3).

Both Δdpt and Δhiv have the expected signs, but only the former is significant at conventional levels. The estimate implies a moderate effect of immunization campaigns on *pimrc*: all else equal, an increase in the proportion of children immunized by ten percentage points is associated with an increase in *pimrc* by close to 0.08 points. However, as outlined above, one should not think of this result as implying that immunizing children against DPT is of predominant importance. It is more likely that increasing the overall effectiveness of public health campaigns should be a priority.[21]

[21] To illustrate this point, changes in the vaccination rates for DPT and measles are highly correlated (correlation

Table 5: Regression analysis of performance indices for under-five mortality, primary completion rate, and gender ratio in secondary education, c. 1990–2009

	pimrc			*picompl*			*piratio*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
growth	0.06***	0.05***	0.05*	0.21***	0.20**	0.22**	0.08	0.06	0.04
	(0.02)	(0.02)	(0.03)	(0.07)	(0.08)	(0.08)	(0.05)	(0.05)	(0.05)
$\Delta educm_{90-09}$		−0.06	−0.02						
		(0.04)	(0.07)						
$\Delta educf_{90-09}$		0.14**	0.10						
		(0.06)	(0.09)						
$\Delta educm_{80-00}$					−0.05	0.15		0.24	0.30
					(0.06)	(0.15)		(0.18)	(0.20)
$\Delta educf_{80-00}$					−0.08	−0.15		0.03	0.13
					(0.11)	(0.15)		(0.13)	(0.15)
$\Delta mepv$			−0.03*			−0.04			−0.04
			(0.02)			(0.04)			(0.05)
$\Delta urban$			−0.01			−0.01			0.01
			(0.01)			(0.02)			(0.04)
gini			−0.32			−4.11**			3.22
			(0.93)			(1.86)			(2.06)
frac			−0.14			1.48**			−0.62
			(0.17)			(0.61)			(0.59)
Δdpt			0.78**						
			(0.38)						
Δhiv			−1.40						
			(0.98)						
Sub-Sahara Africa	−0.23*	−0.27*	−0.29**	0.98**	0.56	0.55	0.19	0.10	0.13
	(0.12)	(0.14)	(0.14)	(0.40)	(0.41)	(0.39)	(0.28)	(0.37)	(0.31)
Middle East & North Africa	0.22*	0.05	−0.04	1.64***	1.54***	1.48**	0.89***	0.45	−0.01
	(0.12)	(0.14)	(0.17)	(0.56)	(0.57)	(0.58)	(0.33)	(0.44)	(0.44)
South Asia	0.12	0.03	−0.17	1.54**	0.63***	0.53*	1.75***	1.06**	1.04**
	(0.15)	(0.14)	(0.15)	(0.71)	(0.22)	(0.29)	(0.51)	(0.47)	(0.41)
Latin America & Caribbean	0.04	0.06	−0.10	0.97***	0.82***	1.18***	−0.15	−0.49	−1.11**
	(0.12)	(0.13)	(0.16)	(0.33)	(0.24)	(0.30)	(0.33)	(0.39)	(0.43)
Eastern Europe & Central Asia	0.21*	0.31*	0.13	0.88	0.16	−0.49	0.46*	0.09	−0.31
	(0.11)	(0.16)	(0.16)	(0.75)	(0.69)	(0.30)	(0.24)	(0.28)	(0.27)
Constant	0.62***	0.51***	0.77*	−0.15	0.39	1.27*	0.71**	0.71	−0.53
	(0.13)	(0.18)	(0.44)	(0.49)	(0.40)	(0.67)	(0.31)	(0.60)	(1.08)
N	114	88	65	63	51	49	47	38	36
R^2	0.30	0.42	0.57	0.27	0.32	0.49	0.46	0.51	0.62
adj. R^2	0.26	0.36	0.45	0.19	0.19	0.33	0.38	0.37	0.42

Notes: Robust standard errors in parentheses. *, **, and *** denote significance at the ten-, five-, and one-percent level, respectively. The reference region is *East Asia & Pacific*.

As expected, the sign on $\Delta mepv$ is negative in all regressions and the coefficient is of similar magnitude. However, the coefficient is significant at the ten-percent level only in the case of under-five mortality, most likely because of the limited number of observations on *picompl* and *piratio*. The results for *gini* and $frac$ are mixed. Significant coefficients are only found in the case of primary completion (column 6). While there is a negative, statistically significant relationship between income inequality and performance as expected, we also find a positive, significant coefficient on $frac$. This result might be driven by significant improvements in some of the African countries, which are latecomers to primary education. It is not unreasonable to assume that ethnic fractionalization determines the *onset* of transitions, but has no role in determining the speed at which countries progress. Since major increases in primary enrollment occured in many African countries even prior to 1970 [e.g. Meyer et al., 1977], it might be more fractionalized countries that have embarked more recently.

Data availability allows us to refine the analysis in the case of *pimrc*. In particular, we calculate performance indices for the two decades seperately and employ a fixed effects-estimator in order to control for unobserved, time-invariant heterogeneity. This means that we can no longer include time-invariant variables since these are picked up by the country-fixed effects. *pimrc* now refers to the performance index calculated for the 1990–2000 and 2000–2009 periods with only one exception: we do not include changes in the intensity of political violence but only means for the respective period (*mmepv*). As parameters are identifiend only from within-variation, it now seems more appropriate to relate changes in performance to changes in the intensity of political violence. Moreover, the time periods considered are sufficiently short to ignore changes in one period. *post*-2000 is a time-fixed effect for the second decade. This variable will allow us to judge progress before and after the MDG framework has been adopted as in Fukuda-Parr and Greenstein [2010] and Hailu and Tsukuda [2011]. More importantly, this variable also picks up unobserved factors that affect all countries to the same degree such as technological advances or changing economic conditions at the global level. The education variables *deducm*, $deducf$ are defined as absolute changes between

coefficient of 0.78 based on 117 observations, p-value ¡ 0.001). Which one is more important? This is not a question that one can answer on the basis of macro data as including both in one regression would result in excessively large standard errors.

1990–2000 and 2000–2010.

Table 6: Performance index for under-five mortality, fixed effects estimates for two periods (1990–1999 and 2000–2009)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
growth	0.04***		0.02***	0.03**	0.03**	0.03**	0.08***
	(0.01)		(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
$post-2000$		0.22***	0.12*	0.12	0.13	0.15	−0.21***
		(0.06)	(0.07)	(0.08)	(0.08)	(0.09)	(0.07)
$\Delta educm$				−0.25**	−0.18*	−0.18*	−0.13*
				(0.10)	(0.09)	(0.09)	(0.08)
$\Delta educf$					−0.11	−0.12	−0.05
					(0.12)	(0.13)	(0.10)
mmepv						0.01	−0.06
						(0.08)	(0.07)
Δdpt							−0.27
							(0.19)
Δhiv							−12.30***
							(1.91)
N	228	282	228	176	176	172	136
Within-R^2	0.11	0.10	0.13	0.22	0.23	0.23	0.71

Notes: Clustered standard errors in parentheses. *, **, and *** denote significance at the ten-, five-, and one-percent level, respectively.

Results are reported in table 6. Compared to our results in table 5, the coefficient on *growth* is somewhat smaller in most specifications but still significant at the one- or five-percent level. The positive coefficient on $post-2000$ in column 2 implies that performance improved after implementation of the MDG framework. However, this is not to say that performance improved *because* of the MDGs. Column 3 shows that higher rates of growth of per capita GNI can account for about 50 percent of the difference. As more variables are included in the regression, the coefficient even changes its sign. What is puzzling here are the negative coefficient on $\Delta educm$ and $\Delta educf$. One explanation could be that de-meaning the data excacerbates measurement error. This would also explain the lower estimates of the coefficients on *growth*. However, while this would induce attenuation bias, it does not explain the negative, *statistically significant* coefficient on $\Delta educm$. Finally, the coefficient on Δhiv seems implausibly large: an increase in HIV prevalence among adults by ten percentage points is associated with a fall in the performance index by 1.2 points. Again, this could be a side-effect of relying exclusively on the within-country variation and the resulting decrease in the signal-to-noise ratio.

7 Conclusion

Compared to earlier efforts of international goal-setting, one of the major innovations of the MDG process has been the introduction of numerical targets, some of which were measurable and time-limited. If international goal-setting for the developing community is to remain a successful venture, both with respect to galvanizing support and delivering the goods, goals should also be realistic. This paper, as well as other contributions before it, demonstates that targets like achieving universal primary education, gender parity in education, or a reduction in under-five mortality by two-thirds are insurmountable for the least developed countries. Hence, the poorest countries will fail to reach the goals by 2015. This feature of the MDG framework jeopardizes the broad public support the MDG process has received in the past and, as these countries are typically the main benficiaries of development assistance, might cause 'aid-fatigue' in donor countries for years to come.

At the same time, we find that once countries embark on a transition towards low levels of mortality, progress often tends to follow a similar pattern with increasing rates of reduction over time. The performance index proposed in this paper is based on the idea that reductions over a given period of time can be compared to expected progress based on this 'average' transition path.

For example, applying this index to the main target under MDG4, the reduction of under-five mortality, we find that while only 37 out of the 141 developing countries considered in this analysis have so far achieved the average annual rate of reduction requried to bring about a reduction by two-thirds over 25 years, 56 countries have managed to outperform the past trend according to the performance index. While only two countries in Sub-Sahara Africa can be counted as being on-track to meet MDG4 by 2015, there are ten countries in the region that have outperformed average progress since 1990. However, comparing progress to past experience also reveals that at the regional level, Sub-Sahara Africa is still found to be lagging behind.

The performance index proposed in this paper consitutes an adequate method to arrive at realistic targets. We demonstrated that our method can be used to calculate performance indices for different MDG indicators such as mortality rates, primary completion rates, and the gender ratio in education. However, this venture less attractive in the case of MDG2 and MDG3. It is important to note that this is not a shortcoming of this particular method, but rather a general problem of the indicators employed within the MDG framework.

Moreover, two things should be noted concerning the politico-economic aspect of international goal setting: first, while achieving average progress on one of the MDGs' numerical targets is certainly realistic, it might well be advantagous for countries to adopt more ambitious goals. However, this does not run contrary to our main assertion that goals should be realistic and should not systematically put certain countries at a disadvantage. In addition, as argued by Bourguignon et al. [2008], it is difficult to imagine that governments will be any less ambitious once they signed-up to the MDGs. Therefore, the MDGs might act as a minimal standard for progress at the country-level.

Second, from a public relations-perspective, the call for 'universal primary education' might be a much more powerful one compared to a call for 'above-average' progress. Policy-makers might find the former goal much more useful in order to galvanize initial support. However, it is also not difficult to see how such a call, once turned into a promise, turns out to be a recipe for disappointment and fatigue.

A Performance indices

Table 7: Initial levels of primary completion, projected level, actual level, and performance index by developing region, c. 1990–2009.

		Primary completion rate			Performance
Country	Period	Initial	Projected	Actual	Index
South & East Africa					
Comoros	1992–2008	39.6	56.9	81.0	2.40
Djibouti	1990–2008	32.0	50.5	2.9	-1.57
Eritrea	1994–2008	18.0	28.4	46.9	2.78
Ethiopia	1994–2008	14.9	23.9	52.1	4.10
Lesotho	1990–2007	58.4	75.4	72.7	0.84
Madagascar	1990–2008	37.0	56.2	71.2	1.78
Malawi	1990–2007	28.1	44.7	54.0	1.56
Mozambique	1990–2008	26.4	43.7	59.4	1.91
Namibia	1992–2008	74.4	86.7	80.8	0.52
Rwanda	1992–2008	44.2	61.6	54.0	0.56
South Africa	1991–2007	75.9	87.8	85.8	0.83
Swaziland	1990–2007	62.7	78.8	72.0	0.58
Tanzania	1992–2007	55.3	70.9	82.6	1.76
West & Central Africa					
Benin	1990–2008	19.5	34.1	65.1	3.12
Burkina Faso	1990–2008	19.3	33.9	38.0	1.28
Burundi	1990–2008	40.9	60.3	45.2	0.22
Cameroon	1990–2008	54.2	72.8	72.7	1.00
Cape Verde	1990–2008	53.6	72.2	92.0	2.06
Central African Republic	1990–2008	30.4	48.6	35.5	0.28
Chad	1990–2007	16.3	28.5	30.9	1.20
Congo, Dem. Rep.	1991–2008	48.4	66.7	53.2	0.26
Congo, Rep.	1990–2008	58.8	76.6	73.1	0.80
Cote d'Ivoire	1990–2008	40.1	59.5	47.7	0.40
Gabon	1992–2003	62.0	73.0	69.5	0.69

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Table 7 —continued from previous page

Country	Period	Primary completion rate Initial	Projected	Actual	Performance Index
Gambia, The	1992–2008	45.1	62.4	79.1	1.96
Ghana	1991–2008	63.7	79.6	82.2	1.16
Guinea	1990–2008	18.8	33.2	54.7	2.50
Mali	1991–2008	12.0	21.7	56.8	4.59
Mauritania	1990-2008	29.1	47.0	64.2	1.96
Niger	1990–2009	15.8	29.5	40.3	1.79
Sao Tome and Principe	1990–2009	77.9	90.7	84.8	0.54
Senegal	1990–2008	41.9	61.4	56.3	0.74
Togo	1990–2007	35.0	52.9	61.3	1.47
Middle East & North Africa					
Algeria	1990-2008	80.8	92.0	113.9	2.96
Iran, Islamic Rep.	1990-2007	83.9	93.4	116.8	3.46
Iraq	1993-2005	57.6	70.1	76.3	1.50
Morocco	1990-2008	51.4	70.3	81.3	1.58
Tunisia	1990-2008	80.3	91.7	92.8	1.10
South Asia					
Afghanistan	1993–2005	28.5	39.9	38.8	0.90
Bhutan	1993–2009	24.3	38.8	88.5	4.42
India	1995–2007	73.9	83.7	93.6	2.02
Nepal	1991–2002	51.1	63.0	70.0	1.59
East Asia					
Cambodia	1994-2008	45.4	60.6	79.5	2.24
Lao PDR	1990-2008	44.6	64.0	74.7	1.55
Mongolia	1995-2008	74.4	84.7	93.3	1.83
Latin America					
Bolivia	1990-2007	71.4	85.3	97.7	1.90
Colombia	1990-2008	73.8	87.5	110.5	2.67
Costa Rica	1990-2008	74.4	87.9	92.9	1.37

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Table 7 —continued from previous page

Country	Period	Primary completion rate Initial	Projected	Actual	Performance Index
El Salvador	1991-2008	65.0	80.6	89.4	1.56
Guatemala	1985-2008	38.7	63.3	80.0	1.68
Honduras	1991-2008	64.0	79.8	89.7	1.63
Nicaragua	1990-2008	39.2	58.5	74.5	1.83
Panama	1985-2008	82.4	95.0	101.9	1.54
Paraguay	1990-2007	65.2	80.7	94.5	1.89
Venezuela, RB	1990-2008	78.8	90.8	95.4	1.39
Caribbean					
Dominican Republic	1994-2008	61.0	74.9	90.7	2.14
Grenada	1985-2008	84.6	96.1	114.4	2.59
Vanuatu	1992-2007	83.4	92.2	79.3	-0.47
Eastern Europe & Central Asia					
Georgia	1995-2008	83.5	91.3	99.7	2.08
Kazakhstan	1994-2009	46.7	62.9	104.8	3.58
Latvia	1995-2008	73.3	83.9	95.1	2.05
Uzbekistan	1994-2008	79.9	89.3	94.7	1.57

Notes: Only countries for which the primary completion rate at the beginning of the period was below 85 percent.

Table 8: Initial levels of gender ratio in secondary education, projected level, actual level, and performance index by developing region, c. 1990–2009.

Country	Period	Gender ratio Initial	Projected	Actual	Performance Index
South & East Africa					
Comoros	1990–2005	0.71	0.83	0.76	0.39
Djibouti	1990–2008	0.69	0.84	0.70	0.01
Ethiopia	1991–2008	0.75	0.88	0.72	-0.25
Kenya	1985–2008	0.75	0.91	0.92	1.04
Malawi	1990–2008	0.57	0.74	0.85	1.66

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Table 8 —continued from previous page

Country	Period	Primary completion rate Initial	Projected	Actual	Performance Index
Mozambique	1990–2008	0.57	0.73	0.75	1.09
Rwanda	1990–2008	0.71	0.85	0.90	1.34
Somalia	1985–2007	0.55	0.75	0.46	-0.45
Uganda	1990–2008	0.58	0.74	0.85	1.68
West & Central Africa					
Benin	1990–2005	0.42	0.56	0.57	1.04
Burkina Faso	1990–2009	0.52	0.70	0.74	1.23
Burundi	1990–2008	0.62	0.78	0.71	0.54
Cameroon	1990–2008	0.69	0.83	0.80	0.77
Central African Republic	1990–2008	0.40	0.57	0.57	1.03
Chad	1990–2007	0.22	0.34	0.45	1.85
Congo, Dem. Rep.	1992–2008	0.48	0.63	0.55	0.47
Congo, Rep.	1990–2004	0.76	0.86	0.86	1.00
Cote d'Ivoire	1985–2002	0.43	0.59	0.56	0.76
Gambia, The	1990–2008	0.47	0.64	0.94	2.76
Ghana	1990–2008	0.67	0.82	0.89	1.46
Guinea	1990–2008	0.34	0.50	0.59	1.53
Mali	1990–2008	0.49	0.66	0.64	0.85
Mauritania	1990–2007	0.47	0.63	0.89	2.59
Niger	1990–2008	0.37	0.54	0.6	1.37
Nigeria	1990–2007	0.76	0.88	0.77	0.13
Senegal	1990–2008	0.51	0.68	0.81	1.75
Sierra Leone	1990–2007	0.49	0.66	0.66	1.05
Sudan	1991–2009	0.79	0.91	0.88	0.74
Togo	1990–2007	0.34	0.49	0.53	1.22
Middle East & North Africa					
Algeria	1990–2005	0.77	0.88	1.08	2.84
Egypt, Arab Rep.	1990–2004	0.77	0.87	0.94	1.72
Iran, Islamic Rep.	1990–2008	0.72	0.86	0.98	1.88

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Table 8 —continued from previous page

Country	Period	Primary completion rate Initial	 Projected	 Actual	Performance Index
Iraq	1993–2005	0.64	0.75	0.67	0.30
Morocco	1990–2007	0.71	0.84	0.86	1.08
Syrian Arab Republic	1990–2008	0.72	0.86	0.98	1.84
Tunisia	1990–2008	0.77	0.89	1.08	2.49
South Asia					
Afghanistan	1991–2007	0.51	0.67	0.38	-0.88
Bangladesh	1990–2007	0.51	0.67	1.05	3.37
Bhutan	1988–2009	0.25	0.41	0.99	4.46
India	1990–2007	0.58	0.74	0.86	1.77
Nepal	1990–2006	0.44	0.59	0.89	2.95
Pakistan	1990–2008	0.42	0.59	0.76	1.99
East Asia					
China	1990–2008	0.74	0.87	1.05	2.32
Indonesia	1990–2008	0.84	0.94	0.99	1.47
Lao PDR	1990–2008	0.68	0.83	0.81	0.83
Latin America					
Bolivia	1986–2007	0.82	0.94	0.97	1.21
Caribbean					
Solomon Islands	1990–2007	0.64	0.78	0.84	1.40
Vanuatu	1991–2004	0.80	0.89	0.86	0.75
Eastern Europe & Central Asia					
Turkey	1990–2008	0.61	0.77	0.89	1.71
Uzbekistan	1986–2008	0.83	0.96	0.98	1.23

Notes: Only countries for which the gender ratio in secondary education at the beginning of the period was below 0.85.

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