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How the New International Goal for Child Mortality is Unfair to Sub-Saharan Africa (Again)

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How the New International Goal for Child Mortality is Unfair to Sub-Saharan Africa (Again)*

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Abstract

The post-2015 development includes level-end goals for both under-five and neonatal mortality to be obtained by 2030: no more than 25 and 12 deaths per 1,000 births, respectively. Recent accelerations in the rate of reduction in under-five mortality have been cited as a cause for optimism. In this paper, we show that changes in mortality rates are subject to mean reversion. Hence, high rates observed recently for Sub-Saharan Africa make for an overly optimistic estimate of future reductions. Taking this into account in projecting mortality rates until 2030, we find that only very few countries in Sub-Saharan Africa are likely to attain the new targets while a majority of countries elsewhere are likely to attain the target or have done so already. We also show that while MDG4 has been rightly criticized as 'unfair' to Sub-Saharan Africa in the past, a relative target may have been more appropriate today and would be relevant for all countries. We also offer a discussion of likely challenges the region faces in making further inroads against preventable deaths.

Keywords: MDGs; SDGs; under-five mortality; Sub-Saharan Africa.

JEL Classification Numbers: I15; I18; J11; J18; O21.

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1 Introduction

> Even if the health MDGs will not be met in all countries by 2015, the gains point the way to further dramatic reductions in the number of deaths [...]. The MDG health targets need to be retained, updated, and expanded. Preventable child deaths [...] should be ended by 2030.
>
> Sustainable Development Solutions Network (2014)

> [...] with the right investments, the stark differences in [...] child death rates between countries of differing income levels could be brought to an end within our lifetimes. Economic growth in many low-income and middle-income countries and the increasing availability of high-impact health technologies make a grand convergence in health achievable by 2035.
>
> Lancet Commission on Investing in Health (2013)

The Millennium Development Goals (MDGs) have been a great success in encouraging development. The Millennium Declaration, from which the MDGs derived, represents an unprecedented consensus among world leaders. As a comprehensive list of goals and targets, most of which were supplemented with indicators and a target date for completion, the MDGs have helped focus debates on some of the most pressing challenges facing humankind and have served as a highly effective advocacy tool for those concerned with improving the lives of the poor (Manning, 2010; Klasen, 2012).

The fourth MDG, a call to reduce the rate of under-five mortality by two-thirds relative to levels in 1990 over the course of 25 years, has received much attention and many countries, particularly in Sub-Saharan Africa, have made exceptional progress towards this goal. But a large fraction of these countries did still not attain the goal and some commentators have argued that MDG4, among other goals, was biased against developing countries and countries in Sub-Saharan Africa in particular (Clemens, 2004; Clemens et al., 2007; Easterly, 2009; Klasen and Lange, 2012).

Nevertheless, proposals during the run-up to the implementation of the Sustainable Development Goals (SDGs), the post-MDG system of goals and targets, called for replacing the target defined in relative terms and turn to a global minimum standard, a level-end goal to be attained in either 2030 or 2035—see table 1 which we adopted from Verguet et al. (2014). Most prominently, the UN Secretary General's High-Level Panel of Emminent Persons (2013, p. 30) at the time called for an end to preventable infant and under-five deaths by 2030, defined as an under-five mortality rate below 20 per 1,000. The UN's Open Working Group (2014) that negotiated in 2014 a new system of SDGs called for ending preventable deaths of newborns and children under five years of age. Both the United Nations' Sustainable Development Solutions Network (2014) and the Lancet Commission on Investing in Health (2013) called for the same target, the latter claiming that "a 'grand convergence' in health is achievable within our lifetimes"—by which

Table 1: Selected proposals for post-2015 global health targets and final target.

	Lancet Commission[1]	Global Investment Framework[2]	UNICEF[3]	SDSN[4]	High-Level Panel[5]	**Agreed as part of SDG3**[6]
Timeframe	2035	2035	2035	2030	2030	2030
Under-five mortality (per 1,000)	16 (interim target of 20 by 2030)	39 in low-, 22 in low-to-middle-income countries.	≤ 20	≤ 20	≤ 20	≤ 25
Neonatal mortality (per 1,000)	–	–	–	–	–	≤ 12

Partly adopted from Verguet et al. (2014).
[1] Lancet Commission on Investing in Health (2013).
[2] Global Investment Framework for Women's and Children's Health (2014).
[3] UNICEF (2013).
[4] United Nations Sustainable Development Solutions Network (2014).
[5] High-Level Panel of Emminent Persons (2013).
[6] United Nations (2015).

they meant the year 2035. Others were slightly more careful but also set level-end targets that seem ambitious for high-mortality countries (e.g. Global Investment Framework for Women's and Children's Health, 2014; UNICEF, 2013).

The UN General Assembly broadly followed these suggestions when it adopted the new agenda (United Nations, 2015). The third goal, a call to "ensure healthy lives and promote well-being for all at all ages," included among 13 further sub-targets one that calls for the end of all preventable deaths of newborns and children. This was supplemented with level end-goals in both cases: until 2030, all countries are to aspire to bring down under-five mortality to no than 25 deaths per 1,000 births and neonatal mortality to no more than 12 deaths per 1,000.

Before the new goal was agreed on, claims that is would be feasible—such as the epigraphs above—have been backed sometimes by costing studies that try to assess what kind of resources it would take to attain the new health target (Boyle et al., 2014; Global Investment Framework for Women's and Children's Health, 2014). Costing studies have also been conducted following the birth of the MDGs (e.g. High-level Panel on Financing Development, 2001; Devarajan et al., 2002). However, it is widely understood that these studies are very crude, abstract from institutional constraints in developing countries, and are easily misinterpreted and sometimes misused (Clemens et al., 2007; Klasen, 2012).

In other cases, backing came through empirical assessments. Verguet et al. (2014) project under-five mortality rates in 2030 based on current annual rates of reduction (ARRs) over five years or 'aspirational' ARRs observed in recent years. The latter were calculated as the 90th percentile of ARRs for all regions, which turned out to range from five percent in Latin America and the Caribbean and 8.3 percent for Eastern Europe and Central Asia. They estimate that between 50 and 64 percent of countries in their sample would achieve this target by 2030. McArthur (2014a) bases projections on twelve-year ARRs and finds that 135 countries are on-track to achieve an under-five mortality rate of 30 or lower by 2030 while 38 are not.[1]

In this paper, we argue that the above-cited empirical assessments are misleading. We show empirically that ARRs for under-five and neonatal mortality are subject to mean reversion, the statistical phenomenon by which random variation in time series data may appear as a meaningful empirical fact. In the context of this study, we demonstrate that high ARRs are more likely to be followed by lower ARRs in the future and *vice versa*. As a consequence, current ARRs are not adequate estimates for future rates. Taking this into account in projections, we find that the likely geographical distribution of projections in 2030 changes towards a clear disadvantage for countries in Sub-Saharan Africa: 45 countries, one-third of our sample, are projected to not attain the new target and 80 percent of these are in Sub-Saharan Africa. Our results for neonatal mortality suggest a geographic distribtuion of 'SDG failures' that is similar qualitatively. At the same time, a 're-newed' MDG4—a call for a reduction in under-five mortality rates by two-thirds over 25 years—results in target rates that are ambitious yet well in reach for nearly all countries.

We also highlight future challenges that need to be overcome in order to further bring down under-five mortality in Sub-Saharan Africa. Economic growth plays a role and high growth rates over the last decade have helped. However, it seems questionable whether high levels of growth can be sustained over the next years. Finally, we will argue that future health interventions will differ considerably from those that were required to bring about the progress we have seen in recent years. Making further inroads will become increasingly more difficult as the focus shifts from low-cost, readily-implementable interventions to policies to improve service delivery and up-take more broadly.

Finding the right trade-off between realism, simplicity, and ambition in setting development goals is of great importance. Unrealistic targets may jeopardize the broad public support the MDG process has received in the past and may cause 'aid-fatigue' in donor countries once it becomes clear that many developing countries will not attain them (Easterly, 2009). There is also some evidence that realistic targets induce effort from governments, at least if incentives are in place (Öhler et al., 2012). Simplicity, on the other hand, has been important for the MDGs' success as a communication tool and the same is true for ambition. Finally, targets for the post-2015 period should be applicable to all countries in order to ensure broad buy-in.

Particular care should be applied in deriving an international development goal for under-five mortality. The child mortality-goal has received much attention in the past, most likely because it is of obvious relevance and easy to understand. Conceptually, it has several advantages over

[1] Based on trends observed between 2000 and 2010, Norheim et al. (2015) suggest an relative overall target for premature mortality, which they define as mortality before age 70, a reduction by 40 percent. This, they argue, could be combined with more specific targets for mortality at certain ages and from certain causes, including a reduction by two-thirds in under-five mortality between 2010 and 2030. They find this would be .

alternatives: first, survival is, for all practical purposes, an actual 'end of development' and a necessary requirement for achieving other capabilities that we have reason to value (Sen, 1998). This is not the case for input indicators (e.g. the number of children vaccinated) which are means to ends. And a focus on ends allows policy-makers to take into account country contexts in determining what policies should be pursued in order to attain them. Second, mortality rates complement records on economic growth as they are responsive to changes in inequality in access to basic services and commodities (ibid.). Finally, under-five mortality is easily measured and the data are widely believed to be of reasonable quality.[2] While this may seem trivial, it is not the case for many other MDG indicators (Attaran, 2005), particularly for those related to health: indicators of food insecurity and undernutrition have been widely criticized (Svedberg, 2002; de Haen et al., 2011) while data on maternal mortality are much more difficult to estimate (e.g. AbouZahr, 2011).

Assessing the likely trajectory for under-five and neonatal mortality still matters even after the specific SDG target has been agreed on: first, it is still important for stakeholders to learn what kind of progress can reasonably be expected. Second, the General Assembly's resolution stresses "national realities, capacities and levels of development" and encourages countries to adopt their own goal guided by the SDG Agenda: "[targets] are defined as *aspirational and global*, with each Government setting its own national targets guided by the global level of ambition but taking into account national circumstances." Each government will further "[...] decide how these aspirational and global targets should be incorporated into national planning processes, policies and strategies." (United Nations, 2015, p. 13, emphasis is our own). Of course, what we end up with even if all countries attain ambitious country-specific targets set in the way we propose in this paper may not add up to the global goal. But this is an inherent tension in the new SDG target.

The paper is organized as follows: the next section reviews recent trends in under-five mortality and their relationship to levels and compares these to MDG4. We relate this to the discussion surrounding the appropriateness of the MDGs. The main point is that ARRs have seen a large acceleration during the last 15–20 years in some of the high-mortality countries but many nevertheless did not attain MDG4. This is in part due to the inappropriateness of the numerical target which, however, seems more appropriate today. Section 3 establishes that there is a substantial degree of mean reversion in ARRs. The consequences of this are further explored in section 4 in which we make projections based on a model that accounts for mean reversion and compare results to projections based on current ARRs. We also compare our projections to target mortality rates that would result from a renewal of MDG4. Section 5 discusses some of the general challenges that high-mortality countries in Sub-Saharan Africa that have made much progress recently are likely to face until 2030. These are important in trying to gauge the prospects of these countries to attain the new target. In particular, the favorable circumstances countries

[2] This is largely the result of an increasing number of comparable cross-country surveys, the Demographic and Health Surveys, that include questions directed at women of child-bearing age about their actual birth histories and thus allow the estimation of mortality rates for children even in the absence of vital registration systems.

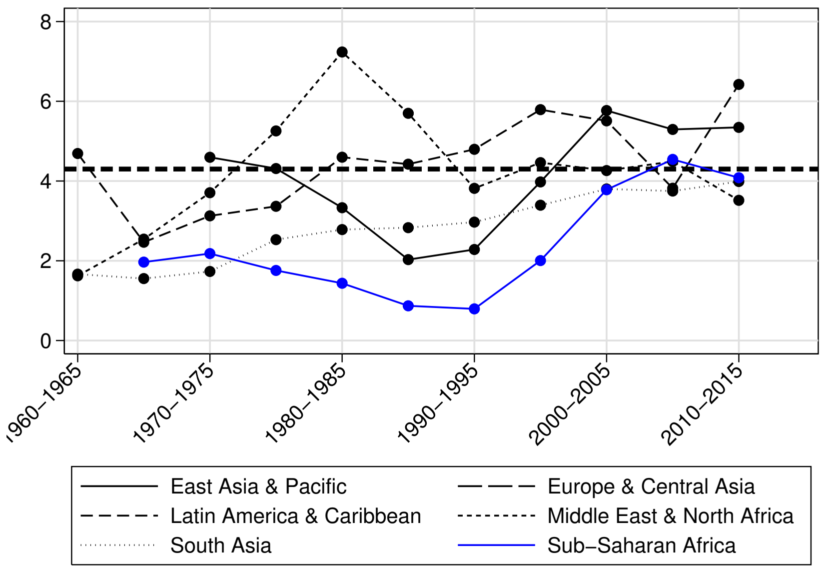

Figure 1: Five-year ARRs for under-five mortality rates by region (excluding high income countries). The dashed horizontal line indicates an ARR of 4.3 percent that would be required to bring about a reduction by two-thirds over 25 years.

have been facing seem likely to deteriorate and interventions that would be needed to make further inroads will have to rely more on state capacity *vis-à-vis* scope. Section 6 concludes.

2 Recent performance and the trouble with the MDGs

Many developing countries, particularly in Sub-Saharan Africa, have made rapid progress towards MDG4. Figure 1 depicts five year-ARRs[3] by regions for under-five mortality since 1960–64. We also indicate an ARR of 4.3 percent, the average annual rate of reduction required by individual countries over 25 years to bring about a decrease by two-thirds; for each country, the target mortality rate under MDG4 in 2015 is

$$M_{2015}^{MDG} = (1/3) \times M_{1990} \approx M_{1990} \times (1 - 0.043)^{25}.$$

The ARRs observed during the 2000s are greater than those for the 1990s in all regions except Latin America and the Caribbean and the Middle East and North Africa. The increase is particularly pronounced in Sub-Saharan Africa. This has been noted elsewhere (e.g. Rajaratnam et al., 2010; Institute for Health Metrics and Evaluation, 2015).

[3]These are obtained from ordinary least squares-regression of log mortality rates against years. Note that a greater number implies more rapid progress. All data come from the World Bank's data repository (accessed on July 15th, 2016, under `http://data.worldbank.org/indicator/`) and are for low and middle income countries.

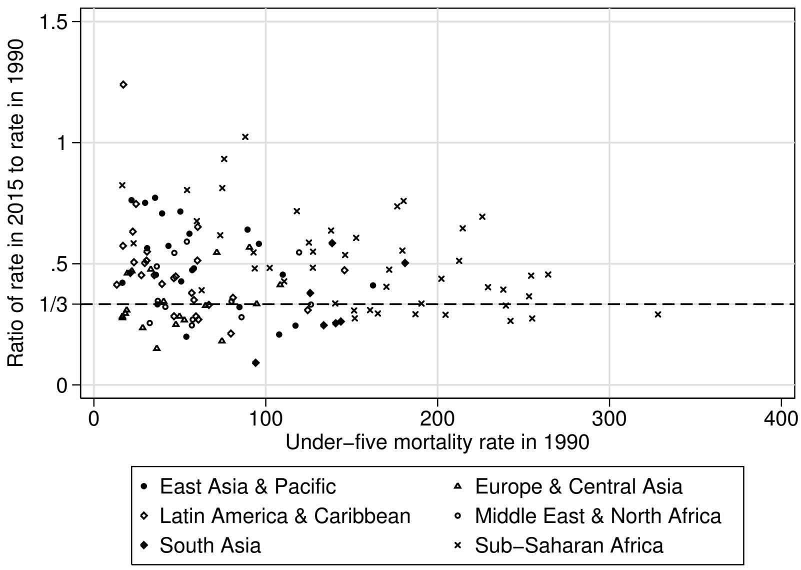

Figure 2: Ratio of under-five mortality rate in 2015 to 1990 against rate in 1990. The dashed line indicates a reduction by two-thirds.

At the same time, it has been noted that many developing countries have not attained MDG4 and that it may have been unrealistic to assume they would in the first place. The first point is illustrated in figure 2 which plots ratios of rates in 2015 to those in 1990 against initial levels and also indicate the 2015 MDG4-target through the horizontal dashed line that indicates a reduction by two-thirds. Overall, only 42 out of 133 countries in our sample have attained the goal. This includes only five out of 22 in East Asia and 10 out of 46 in Sub-Saharan Africa. The best-performing region by this measure was Europe and Central Asia in which eleven out of 19 countries succeeded in attaining the goal.

It is important to note that while the MDGs were frequently interpreted as country-specific goals, they were not conceived in this way. After agreeing on 1990 as the benchmark year, the MDG4 target and others were arrived at by linearly extrapolating from global trends (Vandemoortele, 2009). Thus, the MDGs were to be reached at the global level rather than at the country-level and relied on data from an episode that saw large declines in under-five mortality in the developing world.

Yet for lack of further coordination between actors as to how much each country would have to contribute in order to attain MDG4, the numerical target was frequently interpreted as a national policy goal. National governments, NGOs, and even UN agencies frequently compare progress to the required rate for individual countries. The Global Monitoring Reports similarly discuss progress at the country-level (e.g. World Bank, 2011). It seems very likely that the SDGs will similarly be interpreted at the country-level as there is much demand for local actors for a

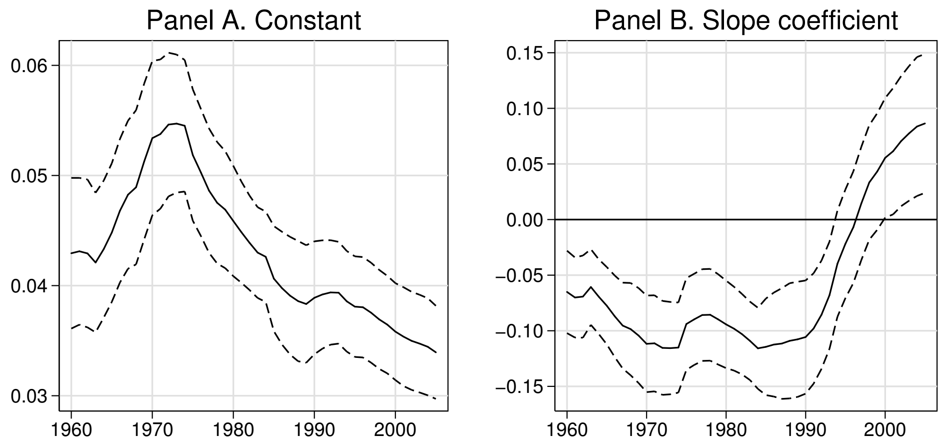

Figure 3: Estimated constant and slope coefficient from a regression of ARRs over ten years against initial levels, 1960–2003. Dashed lines indicate 95-percent-confidence intervals.

yardstick against which to compare their country's progress. It is thus reasonable to contend that future development goals *should explicitly be country-specific*.

If one accepts that stakeholders compared their country's progress against global targets set by the MDGs, two problems become apparent. The first is that the 1990s were in many ways a 'lost decade' for mortality reductions in many developing countries (Easterly, 2009). This is particularly true for Sub-Saharan Africa where countries experienced declining aid budgets, civil strife, the onset of high mortality associated with the HIV/AIDS epidemic, and often a combination of these factors. The result were low ARRs for these countries during the 1990s which are also evident in figure 1. As this was clear by the end of the decade when the MDG targets were conceived, choosing 1990 as the base year dimmed the region's prospects of attaining MDG4.[4]

The second problem is more subtle: there was a negative relationship between ARRs and initial levels in under-five mortality for most of the second part of the last century. High-mortality countries made less progress in relative terms (but more in absolute terms). We can illustrate this point by estimating OLS regressions of ARRs over ten years against initial under-five mortality rates (in percent) for each year in the dataset for which this is possible (i.e. 1960–2005) and including developed and developing countries.[5] Figure 3 illustrates the evolution of the constant (panel A) and the slope coefficient (panel B) from these regressions and 95-percent-confidence

[4]The reasons for choosing 1990 as the base year is likely found in the history of the evolution of the MDGs that took their roots in UN summitry during the early 1990s. The UN's Children's Summit in 1990 already resulted in a relative goal of a reduction in the child mortality rate by one-third over the 1990s. In 1996 the OECD's Development Assistance Committee drew up a list of international development goals that was meant to condense many of the resolutions from individual summits. What would latter become MDG4 already featured on this list. See Manning (2007) and McArthur (2014b) for detailed accounts of the history of the MDGs.

[5]The number of countries changes over time but the overall picture remains unchanged when we restrict the sample to 98 countries for which we have data for all years.

bands (dashed lines). The constant is always positive and significantly different from zero. Low-mortality countries—countries that have mortality rates close to zero—have seen ARRs of three to five percent on average with an uptick during the 1970s. ARRs were lower for high-mortality countries for most of the time: between 1960 and 1990, a ten-percentage point higher mortality rate (e.g. going from 100 per 1,000 to 200 per 1,000) was associated with roughly a tenth of a percentage point lower ARR over the subsequent ten year period. This relationship was significant at the five-percent level throughout and is also consistent with theoretical work on the relationship between natural environments and the pace of mortality transitions (Strulik, 2008).

This indicates that until recently (and possibly as an empirical regularity), setting a target defined in terms of relative changes resulted in a goal that was much more ambitious for high mortality-countries. This is still true for the MDGs since 1990 was defined as as the relevant baseline year. It may have been appropriate now, a point we will return to in section 4 where we analyze the likely consequences of setting a relative target today that would basically replicate MDG4 for the post-2015 era.

But figure 3 also shows that the negative relationship between initial mortality rates and ARRs broke down after the mid-1990s and whether or not a target based on a common rate of reduction is appropriate depends to some extent on whether the relationship will resume in the future. Figure 1 suggests that the recent absence of the relationship is the result of an acceleration in progress against under-five mortality in Sub-Saharan Africa. It is not yet clear what exactly enabled countries in that region to bring about the observed acceleration. Proximate causes likely include low-cost interventions such as insecticide-treated bednets (ITNs) (Demombynes and Trommlerová, 2012) and some more complex ones such as the donor-backed fight against HIV/AIDS. But the underlying causes, the factors that allowed public health campaigns to be implemented in the first place, probably include an exceptional combination of circumstances: relative political stability, high rates of economic growth (probably driven to a significant extent by the commodities super cycle that increased prices for the region's exports), and an increase in official development aid in the wake of the MDGs, particularly to health (Van de Maele et al., 2013).[6] These factors, combined with an environment in which most of the 'low-hanging fruits' had not been reaped, created an exceptional situation during the first decade of the new millennium that allowed high mortality-countries in Sub-Saharan Africa to make inroads against under-five mortality at rates that had not been seen in the previous four decades.

Yet it is an open question whether or not these exceptionally high rates of reduction can be sustained in the future and, therefore, whether or not we should think about the 2000s as a positive outlier. We will return to this question in section 5. Before that, the next section shows that high ARRs are likely to revert to some extent towards their long run mean.

[6]Findings in the literature on aid effectiveness indicate that neither coordination among donors (Nunnenkamp et al., 2013) nor the targeting of aid to poor countries with favorable conditions (Nunnenkamp and Thiele, 2006) has improved much with the advent of the MDGs. Also, aid is rarely found to be well-aligned with recipients' sectoral needs (Thiele et al., 2007). It thus seems that if aid has played a role, it would be through an increase in volume, not efficiency.

3 Mean reversion models

If the 2000s were an exceptionally good decade for mortality reductions in Africa, mean reversion would imply that progress is likely to slow in the future. In this section we investigate this issue empirically. Mean reversion (or *regression toward the mean*) is the statistical phenomenon by which random variation in time series data may appear to be a meaningful empirical fact. Its manifestation are unusually large or small measurements that tend to be followed by measurements closer to the mean (e.g. Barnett et al., 2005). Mean reversion gives rise to several fallacies such as the *Sports Illustrated Cover Jinx* (the notion that teams or athletes that appear on the cover of the *Sports Illustrated* magazine will subsequently experience bad luck) and, similarly, the *Sophomore Slump* (the notion that the "rookie of the year" does less well during the subsequent season) (Schall and Smith, 2000). More significantly, it sometimes leads to the adoption of detrimental behaviors and politics (e.g. the apparent empirical finding that rebukes seem to improve performance while praise seems to backfire (Kahneman, 2002)). Mean reversion is ubiquitous in other economic time series, most notably in growth rates, and has been credited with being responsible for "[m]any great economic forecasting errors of the past half century [...]" (Pritchett and Summers, 2014).

To test for mean reversion in ARRs for under-five mortality and neonatal mortality rates, we use data that come from the UN Inter-agency Group for Child Mortality Estimation (UN IGME)[7] Appendix A lists all 133 countries in our sample. We compute least squares-ARRs for all five year intervals between 1960–1964 and 2010–2014 in order to smooth out noise in the data that may be an issue with year-to-year changes. The base model we estimate using the pooled sample is a regression of ARRs over five years on lagged ARRs (i.e. over previous five-year episodes):

$$ARR_{it} = \beta_0 + \sum_{j=1}^{L} \beta_j ARR_{it-j} + \epsilon_{it}, \quad i = 1, ..., N \text{ and } t = 1965/69, ..., 2010/14. \tag{3.1}$$

We use OLS to estimate (3.1) and thus refer to the resulting estimator as pooled ordinary least squares (POLS).

For simplicity, consider first the case in which $L = 1$, that is, (3.1) is just a regression of ARRs on ARRs lagged once. The coefficients of interest are both β_0 and β_1: if $\beta_0 = 0$ and $\beta_1 = 1$, the ARR observed over the last five years is an unbiased estimate of the ARR over the next five years. At the other extreme, $\beta_1 = 0$ would suggest that current ARRs do not convey any information about future ARRs and that β_0 is the best predictor available for future ARRs, the most extreme version of regression to the mean. Anything in-between would suggest that current ARRs are of some use for prediction and that there is some regression to the mean. If we observe regression to the mean, i.e. $\widehat{\beta}_1 < 1$, the coefficient signals the rate at which the process

[7] These data are estimates based on a large number of sources such as surveys and, if available, vital registration systems. See Alkema and New (2014) for details on the estimation methods and the recent history of that endeavor.

reverts to its long-run mean, the estimate of which is $\widehat{\beta}_0/(1-\widehat{\beta}_1)$.

If we include additional lags, the sum over all coefficients $\beta_1, \beta_2, ..., \beta_L$ conveys information about the extent of mean reversion in ARRs. $\sum_{j=1}^{L}\widehat{\beta}_j < 1$ would suggest mean reversion and the long-run mean is $\widehat{\beta}_0/(1-\sum_{j=1}^{L}\widehat{\beta}_j)$.

We also consider more elaborate model specifications: first, we include on the right-hand side of (3.1) a linear time trend in order to account for secular trends in ARRs, i.e. a trend in the long-run mean. We center this variable on 2015–2019 so that $\widehat{\beta}_0/(1-\sum_{j=1}^{L}\widehat{\beta}_j)$ is the estimated long-run mean at that point in time. Second, we include the contemporaneous growth in GDP per capita.[8] Finally, we show in appendix B that the results presented in this section are fairly robust to estimation methods that account for unobserved heterogeneity across countries and contemporaneous correlation. While we find some evidence for the presence of unobserved, country-specific heterogeneity, results using more sophisticated estimators show that POLS will only tend to attenuate the extent of mean reversion.

Results are reported in table 2 for all developing countries. Standard errors clustered at the country-level are reported in parentheses throughout. Consider first the simple model with one lag as the sole regressor reported in column (1). Note that the first observation on the outcome is for 1965–1969 as there is no observation on the lagged dependent for 1960–1964. The more lags we include, the smaller the time dimension of our sample.

The R-squared of this regression is one-third. Hence, there is evidence that past ARRs predict future ARRs to some extent. However, we also find evidence for mean reversion. The coefficient on the lagged ARR is significantly different from both zero and unity at the one-percent level. It suggests that ARRs revert to their long-run mean at a rate of about 0.45 percent every five years. The estimate for the long-run mean is an ARR of $0.016/(1-0.550) \approx 3.5$ percent. Note that this ARR is much lower than the 4.3 percent required to bring about a reduction in under-five mortality by two-thirds over the course of 25 years, the target under MDG4.

The model reported in column (2) includes one additional lag of the ARR which also turns out highly significant.[9] The long-run mean is very similar to the one we report above. The model reported in column (3) includes a linear time trend and two lags of the dependent. Coefficients on lagged variables are very similar to those found before and remain significant. The coefficient on the trend variable is positive and significant at the five-percent level. It suggests that, on average, ARRs increase by about one-tenth of a percentage point every five years. The long-run mean in 2015-2019 is estimated to be about 4.1 percent.

The model reported in column (4) includes contemporaneous growth rates in GDP per capita. We re-center this variable by subtracting its mean, 0.037. That way, the long-run mean of the dependent that we report corresponds to the long-run mean at average growth rates of GDP per capita. All coefficient estimates are statistically significant at least at the five-percent level. Coefficients on lagged dependent variables remain fairly stable. The coefficient on the growth

[8]The data come from the Penn World Tables Mark 9.0 (Feenstra et al., 2013). We use real GDP at constant 2005 national prices since we are not interested in cross-country comparison.

[9]Higher order-lags turned out to be insignificant in all specifications.

Table 2: Results from POLS regressions: testing for mean reversion in quinquennial ARRs for under-five and neonatal mortality, all developing countries.

	ARRs, under-five mortality rates						ARRs, neonatal mortality rates	
	1965–2010	1970–2010			1970–1995		2000–2010	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ARR_{it-1}	0.550***	0.613***	0.608***	0.604***	0.604***	0.622***	0.640***	0.747***
	(0.045)	(0.077)	(0.077)	(0.083)	(0.089)	(0.094)	(0.090)	(0.139)
ARR_{it-2}		-0.158***	-0.159***	-0.194***	-0.136**	-0.166**	-0.106*	-0.206*
		(0.058)	(0.058)	(0.061)	(0.063)	(0.067)	(0.064)	(0.105)
t			0.001**	0.001**	-0.001	-0.000	-0.001	-0.008***
			(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.003)
$GDP\ p.c.\ growth_{it}$				0.133***		0.123***		0.121**
				(0.035)		(0.038)		(0.047)
$Constant$	0.016***	0.019***	0.022***	0.019***	0.012***	0.013***	0.012***	-0.011
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.008)
$\sum_j \widehat{\beta}_j$	0.55	0.45	0.45	0.41	0.47	0.46	0.53	0.54
Estim. long-run mean of ARR	0.035	0.035	0.041	0.033	0.023	0.023	0.027	-0.025
Observations	1,140	1,007	1,007	760	608	530	399	230
Countries	133	133	133	115	132	114	133	115
R-squared	0.289	0.293	0.296	0.362	0.294	0.353	0.354	0.393

Standard errors clustered around the country-level in parentheses. *, **, and *** denote significance at the ten-, five-, and one-percent level, respectively.

variable suggests that, *ceteris paribus*, a one percentage point higher growth rate increases the ARR by about 0.13 percentage points. The implied elasticity is somewhat lower that those reported in the literature.[10] Finally, in columns (5) and (6), we restrict the sample to observations that predate the MDG era, that is, we exclude all observations on ARRs recorded prior to 2000. We re-estimate models reported in columns (3) and (4) and find that the results are similar except for a lack of significance on the linear time trend-variable.

We also re-estimate specifications in columns (3) and (4) using ARRs for neonatal mortality, an indicator that has also been added to the SDG framework (columns (7) and (8)). Data on this variable are only available from 1990 onwards so that with two lags included as regressors, the first dependent variable we can use is the one for 2000–2004 and the usable panel spans only three time periods. Results are similar qualitatively in that there is strong evidence for reversion to the mean. In the specification that excludes growth in column (7), we find that the estimate of the long-run mean is comparable to the ones we found previously for ARRs for under-five mortality at about 2.7 percent per year. The coefficient estimate on growth is also comparable. Yet once it is included, we find that the long-run mean in 2015–2019 at an annualized growth rate of 3.7 percent per year is *negative*, suggesting that neonatal mortality would actually increase over time if growth does not pick up significantly and sustainably. This seems to be a consequence of recent developments—some commentators have noted that progress against neonatal mortality may be slowing and this is also evident in figure 4—in combination with a panel that covers only recent years.

As an additional robustness check, we re-estimate some of the specificaitons in table 2 with data on ARRs in under-five mortality rates only for the 46 Sub-Saharan African countries in our sample (table 3). As one would expect, we find that long-run means are somewhat lower yet the increase over time, the coefficient on t, is greater if we consider all periods that can be included (column (2)). The sum over estimated coefficients on lagged dependent variables is lower, suggesting that mean reversion may be even more important. Hence, our main finding of a strong tendency of ARRs to revert to the long-run mean remains intact.

While our finding of substantial mean reversion seems fairly robust at this point, one may still wonder whether it is driven by particular modeling decisions that went into the production of the data. The data are based on modeled estimates provided by UN IGME. This may not be of great importance as these are the data that form the basis of similar assessments and are used to monitor and evaluate progress towards international goals. But it is also likely that if the data were raw data from vital registration systems, we would in all likelihood find a *greater* extent of mean reversion: IGME estimates are based on penalized splines that combine information across years and data sources (Alkema and New, 2014). As a result, the estimated data are smoothed in levels and we would thus expect greater correlation between changes over time.

What does mean reversion imply for the recent discussion surrounding under-five mortality and international development goals? First, recent calculations based on counterfactuals that

[10] Pritchett and Summers (1996), for instance, find an elasticity of infant mortality rates with respect to GDP per capita of about −0.2 to −0.4 percent.

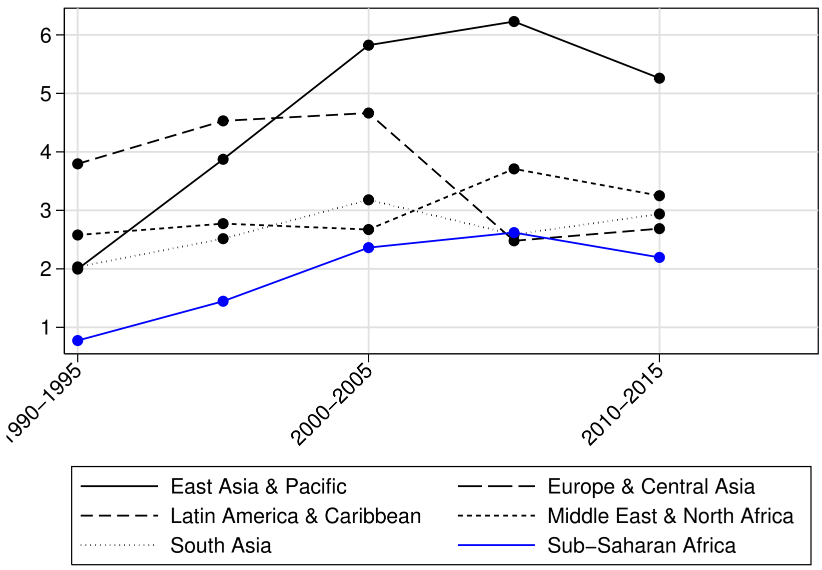

Figure 4: Five-year ARRs for neonatal mortality rates by region (excluding high income countries).

assumed a continuation of slow progress against under-five mortality over the MDG-period in high mortality countries tend to overestimate the effect the MDGs may have had. The above results show that mean reversion is a robust characteristic of the data and there is little doubt that events during the early 1990s in Sub-Saharan Africa, the region with the highest level under-five mortality, constituted a negative shock to under-five mortality that temporarily derailed the region from its steady-state ARR. A before-after comparison based on 1990s ARRs will thus overestimate the effect of MDG4 on the ARR and on levels.

To see this, consider a simple numerical example that assumes dynamics as estimated in the first column of table 2: there is only one lagged dependent variable and the coefficient on that variable is 0.55. This parameter will govern the rate at which the series will tend to revert to its long-run mean following a shock. If, for instance, a shock knocks off one percentage point off the ARR in one period and the ARR was previously at its long-run mean, we would expect to see an ARR that is 0.55 percentage points below the long-run mean in the next period, $0.55^2 \approx 0.3$ percentage points lower in the following period, and so on. This would be the correct counterfactual—it is based on an unbiased estimate of the ARR absent any shock.

In the case of Sub-Saharan Africa, relying on the assumption that trends during the 1990s would have continued in the absence of any goals (or any other intervention) will very likely lead to an over-estimation of the number of lives saved. In other words, the improvement in the pace of mortality reduction in the 2000s in Sub-Saharan Africa is in part due to mean reversion and

Table 3: Results from POLS regressions: testing for mean reversion in quinquennial ARRs, only countries in Sub-Saharan Africa.

	1960–2005			1960–1995	
	(1)	(2)	(3)	(4)	(5)
ARR_{it-1}	0.735***	0.696***	0.639***	0.560***	0.515***
	(0.112)	(0.118)	(0.144)	(0.192)	(0.174)
ARR_{it-2}	-0.375***	-0.362***	-0.429***	-0.371***	-0.386***
	(0.073)	(0.066)	(0.071)	(0.095)	(0.097)
t		0.002***	0.001*	-0.002*	-0.002**
		(0.001)	(0.001)	(0.001)	(0.001)
$GDP\ p.c.\ growth_{it}$			0.168*		0.171*
			(0.084)		(0.088)
$Constant$	0.017***	0.026***	0.019***	0.005	0.001
	(0.002)	(0.005)	(0.004)	(0.006)	(0.005)
$\sum_{j=1}^{L} \widehat{\beta}_j$	0.360	0.333	0.210	0.189	0.129
Estim. long-run mean of ARR	0.026	0.039	0.024	0.006	0.001
Observations	363	363	305	225	219
Countries	46	46	43	45	42
R-squared	0.38	0.41	0.44	0.24	0.35

Standard errors clustered around the country-level in parentheses. *, **, and *** denote significance at the ten-, five-, and one-percent level, respectively.

that part should arguably not be attributed to the MDGs.[11]

Second, and more importantly for the present study, assuming persistence in currently very high ARRs will result in overly optimistic projections for under-five mortality reductions for Sub-Saharan Africa: just as the counterfactual was too pessimistic in the past when progress was sluggish, projections based on linear extrapolations are too optimistic today as countries in Sub-Saharan Africa are making substantial inroads. The consequences of this for goal-setting will be analyzed in more detail in the section that follows.

4 Projections and development targets

In tis section we compare future mortality rates projected using two different methods, the mean reversion models estimated in the previous section and a simple extrapolation of current ARRs into the future. We will investigate the implications for the new targets for under-five and neonatal mortality. In the second part, we investigate what implications mean reversion

[11] Note that we are not claiming that *all* of the large increase evident in figure 1 could have been expected based on our finding of mean reversion. We are just claiming that the construction of the counterfactual should take into account mean reversion and that that would have suggested an modest increase in ARRs in Sub-Saharan Africa even in the absence of any goals.

would have for the feasibility of hypothetical target that reproduces MDG4 today for under-five mortality.

4.1 Persistence vs. mean reversion

We base our projections on results of the mean reversion models reported in columns (3) of table 2 for under-five and neonatal mortality, respectively. For the first set of projections, we retain the relevant parameters from the regression and compute one-period-ahead-ARRs as

$$\widetilde{ARR}^{MR}_{it+1} = \widehat{\beta}_0 + \widehat{\beta}_1 ARR_{it} + \widehat{\beta}_2 ARR_{it-1} + \widehat{\gamma}(t+1). \tag{4.1}$$

By moving (4.1) forward through time, we obtain a series of ARRs that will converge to the long-run mean. From this series we can calculate the projected mortality rates in 2030.

For comparison, we also calculate projected mortality rates in 2030 based on the assumption that the last ten year-ARRs that we observe, those recorded between 2005 and 2014, will be persistent in each country individually:

$$\widetilde{ARR}^{P}_{it+1} = ARR_{it}.$$

Based on this, it is straight-forward to calculate projected levels of under-five mortality in 2030. In principle, this is what is done by McArthur (2014a) who extrapolates based on ARRs observed between 2001 and 2013.

Both projections will tend to result in underestimates of under-five mortality in Sub-Saharan Africa in the future. The persistence model relies on ARRs observed between 2005 and 2014 and these were higher for most Sub-Saharan African countries than in most other ten-year periods for which data are available. McArthur (2014a), for instance, uses twelve-year ARRs in order to "attenuate the risk that some countries might have seen unusually high rates of progress in the most recent years." The mean reversion model is also conservative in the sense that we may tend to err on the side of feasibility: first, we base our projections on a model that includes a linear time trend and our results suggest that, on average, ARRs increase over time. Second, the model we rely on for projections includes neither country- nor region-fixed effects. Therefore, ARRs will tend to converge to a global long-run mean (subject to a positive time trend) rather than country- or region-specific means. The global mean, in turn, was higher than that for Sub-Saharan Africa: the consecutive long-run means estimated from this model for 1960–1964, 1980–1984, 2000–2004, and, out-of sample, 2020–2024 are 0.027, 0.032, 0.037, and 0.042. Comparing these numbers to those reported in figure 1, we see that Sub-Saharan Africa's ARR was usually much lower and higher only between 2000 and 2009. Third, the degree of persistence is higher than in models including country-fixed effects (see appendix B). Finally, the model we use does not allow for the pattern of relative divergence that we find for previous decades (see section 2).

It is important to note that the aim of this exercise is not to make detailed country-specific

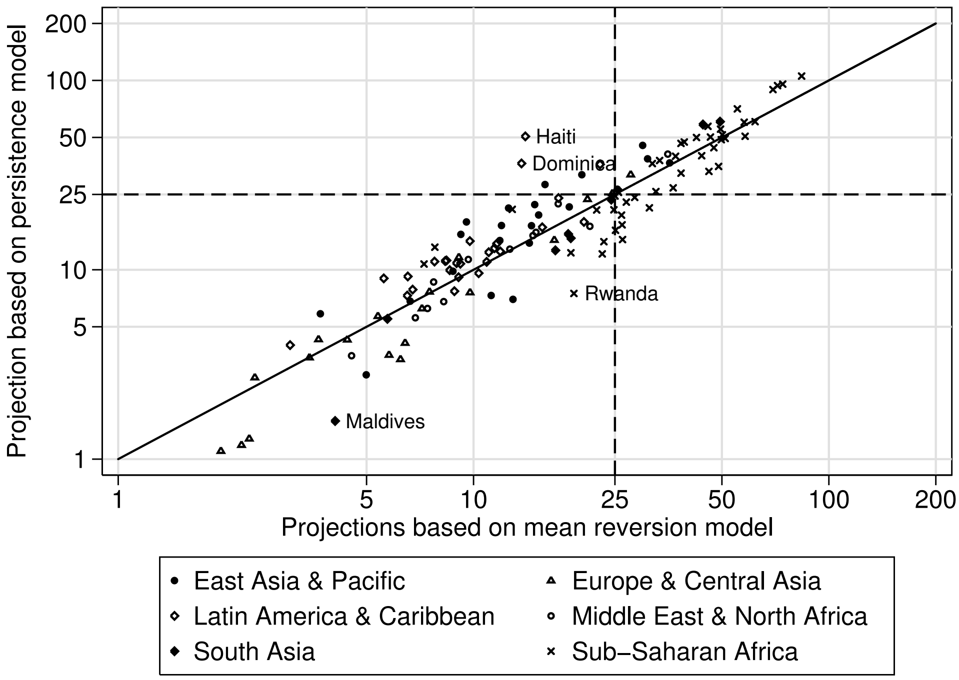

Figure 5: Projections of under-five mortality based on persistence model against projections based on mean reversion model. The dashed lines indicate the new goal, an under-five mortality rate of 25 per 1,000. The solid line is a 45-degree-line. Both series are plotted on a log scale.

projections; these can and should consider more specific information. They also involve a substantial degree of uncertainty: the R-squared of the mean reversion model reported in column (3) of table 2 is only 0.37. While the R-squareds for many other models that we estimate are higher, particularly when country-fixed effects are included as in appendix B, a large portion of the variation in the data remains unexplained. More generally, it is clearly beyond the scope of the present study to make statements about the likely extent and locality of major public health crises such as epidemics. Nevertheless, the exercise is useful to gauge the potential for reductions if major crises can be averted, a policy goal that should be seen as implicit in international goal-setting exercises.

Our results for under-five mortality are depicted in figure 5 where we plot projections from the persistence model against projections from the mean reversion model. Both projections are plotted on log scales. The dashed lines represent the new target, a mortality rate of 25 per 1,000. We also add a 45-degree-line to this graph for reference.

All countries located in the bottom-right corner of the graph will attain the goal if current ARRs turn out to be persistent but will not attain the goal if they experience regression to the mean. On the other hand, countries located in the top-left corner of the graph will not attain the goal under persistence but will attain the goal if there is regression to the mean. Note again what is driving differences in projections: countries that are below the 45-degree-line are projected to have much lower child mortality rates based on the persistence model. Examples include Rwanda and the Maldives which we highlighted in figure 5. These are also the two countries that have had the highest ARRs over the 2005–2014 period at roughly ten percent per year. Haiti and Dominica, on the other hand, have had very low ARRs.[12]

The first thing to note is that there is a strong linear relationship between the two sets of projections. The correlation coefficient between logs of projected under-five and neonatal mortality rates is 0.93 and 0.96) and both are highly significant (p-value < 0.0001). Based on an unpaired t-test (allowing for unequal variances), we cannot reject the null of equal means (p-value $= 0.85$). Results are similar for projected neonatal mortality rates (p-value $= 0.59$). There is no tendency for either approach to result in systematically higher or lower projected mortality rates *on average*.

The geographical distribution of mortality rates, however, differs considerably. Several countries in the bottom-right corner of the graph, all of them located in Sub-Saharan Africa, are projected to attain the target if current ARRs are also future ARRs but will fail to do so under regression to the mean. On the other hand, countries in the top-left corner, those that will attain the target if they experience regression to the mean but not if there current ARRs persist, are located in East Asia and the Pacific region and in Latin America and the Caribbean.

Table 4 allows a closer inspection of these regional differences. We tabulate the total number of countries by region, the number of countries that had attained levels of 25 (12) child (neonatal) deaths per 1,000 already in 2015, and the number of countries projected to attain the new goal in 2030 with and without taking into account mean reversion, respectively. Note that the latter considers only countries for which the goal is still relevant in the sense that they had not crossed the line already by 2015.

We first consider panel A which reports projection results for under-five mortality. More than two out of five developing countries in our sample had attained the target by 2015—*even before it was agreed on*. The share of countries is particularly high in Europe and Central Asia (79 percent) and in Latin America and the Caribbean (81 percent). The share is particularly low in Sub-Saharan Africa, where only three out of 46 countries had attained the target by 2015. Thus, the new target seems to be of little relevance to a large number of countries outside Sub-Saharan Africa yet relevant to almost all countries in Sub-Saharan Africa.

The two sets of projections result in the same number of developing countries that will attain the target in the Middle East and North Africa and in South Asia. Mean reversion suggests that all five countries in Latin America and the Caribbean will attain the target while only three will

[12] Rwanda's success and the challenges faced by Haiti are well documented. The former was very successful in providing public health services (e.g. Save the Children, 2015) and large gains were possible due to the emergence from a severe civil war during the 1990s. The latter was affected by a severe earthquake in 2010 and the worst outbreak of cholera in years in the direct aftermath. It is less clear what happened in the Maldives and Dominica. However, both countries may be special cases as they are small island states with very low under-five mortality rates to begin with. Interestingly, the five worst performers between 2005 and 2014—Dominica, Tonga, Vanuatu, the Seychelles, and Fiji—are all small island states with comparatively low levels of under-five mortality to begin with.

Table 4: Number of countries by region that are projected to attain an under-five mortality rate of less than 25 per 1,000 and a neonatal mortality rate of less than 12 per 1,000 by 2030.

				Attaining the target by 2030 (out of those that had not attained the target by 2015)			
	# of countries	Attained before 2015		without mean reversion		with mean reversion	
		#	Share	#	Share	#	Share
Panel A. Under-five mortality.							
East Asia & Pacific	22	10	0.45	6	0.50	8	0.67
Europe & Central Asia	19	15	0.79	2	0.50	3	0.75
Latin America & Caribbean	26	21	0.81	3	0.60	5	1.00
Middle East & North Africa	12	7	0.58	4	0.80	4	0.80
South Asia	8	2	0.25	4	0.67	4	0.67
Sub-Saharan Africa	46	3	0.07	14	0.33	6	0.14
All	133	58	0.44	33	0.44	30	0.40
Panel B. Neonatal mortality.							
East Asia & Pacific	22	10	0.45	6	0.50	6	0.50
Europe & Central Asia	19	15	0.79	1	0.25	0	0.00
Latin America & Caribbean	26	20	0.77	2	0.33	1	0.17
Middle East & North Africa	12	6	0.50	3	0.50	3	0.50
South Asia	8	2	0.25	2	0.33	1	0.17
Sub-Saharan Africa	46	3	0.07	8	0.19	6	0.14
All	133	56	0.42	22	0.29	17	0.22

Projections without mean reversion are based on the assumption of persistence in ARRs observed between 2005 and 2014. Mean reversion-projections for under-five and neonatal mortality are based on estimates reported in columns (3) and (7) of table 2.

do so under persistence. In Europe and Central Asia, three rather than two out of four will cross the line under mean reversion as compared to persistent rates.

In terms of absolute numbers, the largest differences are observed for Sub-Saharan Africa. 14 out of 43 countries are projected to attain the target under persistence (in addition to the three that have done so already). This scenario would result in almost seventy percent of the future 'SDG failures' hailing from Sub-Saharan Africa. Under the mean reversion scenario, only six out of 43 countries are projected to attain the target. This scenario would see more than 80 percent of failures hailing from Sub-Saharan Africa. Note that only one-third of the countries in our sample are Sub-Saharan African.

Interestingly, our projections with regard to the number of countries attaining the new target are similar to findings reported in a recent study by Liu et al. (2015). Based on a more detailed method that considers shifts in causes of death, they find that more than a third of the countries in their sample will not achieve the 2030 target and that almost three-quarters of these will be in Sub-Saharan Africa.

Our findings for the new neonatal mortality goal are very similar qualitatively yet fewer countries are projected to attain the target in almost all regions and particularly under mean reversion. In brief, both sets of projections result in projections that suggest that the majority of countries in Sub-Saharan Africa will fail and this is more pronounced if mean reversion is taken into account. Arguably more important is the observation that in some regions the majority of countries has already attained the new goals.

Could high rates of economic growth put the target within reach for more countries in Africa? In order to quantify the potential contribution of growth and to test the sensitivity of our projections above, we calculate a set of alternative projections based on estimates reported in column (4) of table 2 for which we rely on varying assumptions about future growth rates of GDP per capita. Results are reported in appendix C. They suggest that if all countries in Sub-Saharan Africa manage to maintain a growth rate of five percent per year, still only 23 percent of the countries in this region for which the target is relevant will have attained it come 2030. This percentage increases to 35 percent for a very high growth rate of ten percent annually. All but four non-African countries that have not trivially attained the target would cross the line given this rapid pace of economic development. Remember that these projections are conservative in the sense that they will tend to overestimate future ARRs and thus underestimate future mortality rates. Models that account for country-specific long-run ARRs result in a greater degree of mean reversion and lower long-run ARRs for Sub-Saharan African countries (see the discussion and results in appendix B).

Three messages should be taken away from this: first, irrespective of the underlying assumptions, Sub-Saharan Africa is always the one region in which the smallest share of countries stands a chance at success. Second, mean reversion matters. If only a weak form of it will materialize in the future, the absolute number of countries that will be SDG success stories from Sub-Saharan Africa will be extremely limited. Third, there is a substantial number of developing countries that has attained the target even before it was sanctioned, but only three of them are in Africa. The proposed new target seems both overly ambitious for Sub-Saharan Africa and *irrelevant* for a large number of countries elsewhere.

We have seen before that it is just for recent years that there is no negative relationship between intitial levels and subsequent rates of reduction. Hence, a target defined in relative rates may be unbiased in the sense that it constitutes the same degree of ambition for all countries. Yet the UN have opted for a target that reproduces regional biases in the previous child mortality goal that have been noted and criticized before (Clemens et al., 2007; Easterly, 2009; Klasen and Lange, 2012). While these biases were a result of choosing 1990 as the base year and, to a lesse extent, ignoring systematic differences in ARRs that were apparent at the time, they now stem from adopting a level end-goal. Yet the result will be very much the same. In what follows, we will further explore this last point by analyzing how our projections compare to a hypothetical 're-newed' MDG4.

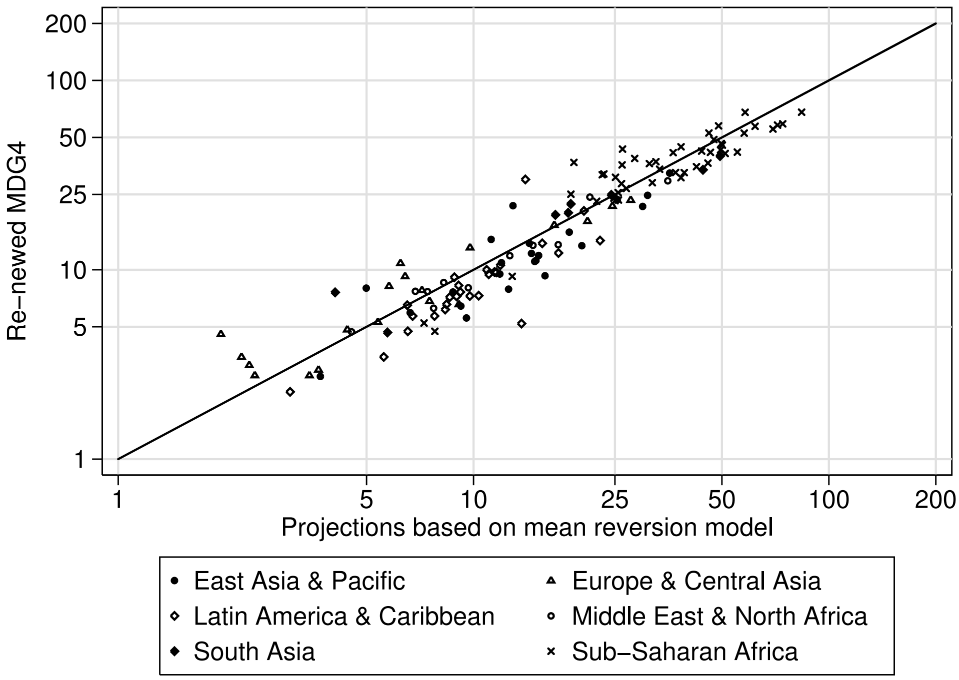

Figure 6: Under-five mortality rates as required by a 're-newed' MDG4 (two-thirds reduction relative to levels in 2005) against projections based on mean reversion-model. Both series are plotted on a log scale.

4.2 A new MDG4?

How would our assessment of Sub-Saharan Africa's prospects change if the new under-five mortality target would have simply replicated the old target? We have argued above that in 2000, setting 1990 as the base year and calling for a reduction by two-thirds was overly ambitious for most countries in Sub-Saharan Africa. This time could be different as (1) there is a tendency for ARRs to increase over time, (2) countries in Sub-Saharan Africa have an advantage in that they have seen high ARRs over the last ten years,[13] and (3) given a degree of persistence in the data, this momentum will carry over to some extent to future ARRs. Given mean reversion, one advantage of a target defined in relative terms today would be that the focus would shift from countries with high levels of under-five mortality to countries with low ARRs in recent years. Re-newing the old target would also have had the advantage that it would be immediately

[13]Note that we do not claim that much of this is the result of mean reversion. In fact, mean reversion does not imply that ARRs below the long-run mean will be followed by ARRs above the long-run mean. In fact, the nature of mean reversion only suggests below-average ARRs will tend to be followed by below-average ARRs that are somewhat closer to the long-run mean. More likely, high ARRs are a consequence of a favorable economic environment that saw prices for Sub-Saharan Africa's exports increase, relative political stability, and, possibly, a re-newed commitment to delivering quality health services by both policy-makers and donors.

relevant for all countries.[14]

Replicating the old MDG would see 2005 as the base year and calling for a reduction by two-thirds until 2030. The target mortality rate is thus

$$M^*_{i,2030} = (1/3)M_{i,2005}.$$

Figure 6 compares our projections from above (i.e. based on estimates reported in column (3) of table 2) to this quantity. Again, both series are plotted on log scales. Countries above the 45-degree-line are projected to attain the target while countries below the line are projected to have lower mortality rates in 2030 than would be required under a new MDG4.

Table 5 reports the exact numbers of countries that are projected to attain the actual target and a renewed MDG4 by region and including countries that have attained the new target already. We also report the corresponding shares as well as the average shortfall of those that do not attain the target. The latter is defined as the difference between projected deaths per 1,000 and the respective target.

Our mean-reversion projections suggest that a renewed MDG4 would have been much more ambitious for countries on average: only 47 countries (35 percent) are projected to attain this target yet 88 countries (66 percent) are either projected to attain the new target in the future *or have done so already*. This pattern is reversed only in Sub-Saharan Africa where 20 countries would seem more likely to attain a renewed MDG4 *versus* nine that are projected to attain the new goal. The reason for this is that countries in Sub-Saharan Africa have seen high ARRs in recent years and this momentum is going to carry over to some extent into the future.

It is also worth noting that the average gaps are projected to be modest if MDG4 would have been renewed. The average shortfall from the target for countries that are not projected to cross the line is only about 3.6 deaths per 1,000 in Sub-Saharan Africa and lower elsewhere. Hence, the average country may not automatically reach the target yet the it would likely be well in reach. In fact, a more ambitious relative goal would have been an option. This contrasts with average gaps under the SDG target: there is both large variation across regions and a large average gap in Sub-Saharan Africa. Again, this suggests that the new SDG target is plainly unrealistic for many countries in that region.

Taken together, a renewed MDG would be somewhat ambitious yet in reach for most countries. It would be more demanding of countries that have seen below-average progress in recent years so that the focus would shift away from levels towards recent performance. Of course, projections presented in this section are premised on the assumption that there will be no return to the pattern of relative divergence discussed in section 2 (which we argued is still very much possible).

[14] A focus on countries with high levels of mortality might lead to more deaths averted than a focus on those with low ARRs. However, if that were important, goal-setting should additionaly consider population size (which none of the goals do). We focus here on setting realistic goals for countries, not on trying to optimize global mortality reduction.

Table 5: Number of countries projected to attain a 'renewed' MDG4 and the new SDG-target by 2030, by region and based on mean-reversion model.

		Renewed MDG4			SDG target		
	# of countries	#	Share	Average gap, non-performers	#	Share	Average gap, non-performers
East Asia & Pacific	22	3	0.14	2.89	18	0.82	0.99
Europe & Central Asia	19	11	0.58	0.78	18	0.95	0.14
Latin America & Caribbean	26	3	0.12	2.08	26	1.00	0.00
Middle East & North Africa	12	5	0.42	1.53	11	0.92	0.85
South Asia	8	5	0.62	2.64	6	0.75	5.45
Sub-Saharan Africa	46	20	0.43	3.58	9	0.20	14.84
All	133	47	0.35	2.53	88	0.66	5.72

Projections are based on estimates reported in column (3) of table 2.

5 Challenges ahead

The previous sections have shown that there is substantial evidence for regression to the mean and that accounting for this results in projections suggests a regional distribution that implies a bias against countries in Sub-Saharan Africa. These countries have seen ARRs that were probably far above their long-run mean and are thus likely to decrease somewhat until 2030.

But what are the prospects for factors that have contributed to the rapid decline in under-five mortality? In this section, we turn to some of the new challenges that countries in the region will have to meet in the future in order to bring about further reductions. We start off by discussing the prospect for maintaining high growth rates of GDP per capita. There is broad agreement that growth in GDP was exceptionally high in recent years and our own analysis shows this to be robustly associated with reductions in mortality rates (section 3). Yet there are several indications that growth is likely to be lower in the future and, in fact, already starting to slow down.

We then consider public health interventions. We argue that the kind of policies that are required in the future to bring down mortality rates further will differ substantially from those that have been implemented succesfully in recent years in that they depend more on state capacity to be successful. Countries in Sub-Saharan Africa are thus facing the double challenge of sustaining the kind of policies that have been successful while chartering new territory—all in an environment that will be less conducive to attaining ambitious targets.

5.1 Sustaining economic growth

Sub-Saharan Africa's growth in output is widely believed to have exceeded five percent per year since the mid-1990s. This would make the region second only to emerging and developing Asia in terms of recent economic development (IMF, 2014, p. 184). Our results above suggest that economic growth is robustly associated with higher ARRs, although our estimate of the elasticity is not particularly high. We have nevertheless argued that sustained growth would somewhat improve the region's prospects with respect to the new child mortality goal (see appendix C). It is thus worthwhile to ask whether growth will continue its role in facilitating progress. We argue that it is unlikely that this will be the case.

One point about Sub-Saharan Africa's recent growth performance is that we cannot be all too certain about it as the region's growth data are inherently unreliable (Jerven, 2010). There have been alternative takes at growth in Sub-Saharan Africa, notably by Young (2012). He bases his measurement of real consumption on easy-to-observe indicators such as the quality of housing and the ownership of durable assets. His estimates suggest that living standards have been growing at a rate between three and four percent per year. However, it has been questioned whether this approach is actually useful (e.g. Harttgen et al., 2013).

But let us assume for now that Sub-Saharan Africa's growth performance has rivaled East Asia's for the last ten to 15 years. Will it be possible to maintain these rates of growth? One point that casts doubt on this prospect is the absence of any signs of structural change in Sub-Saharan Africa in recent years towards manufacturing (McMillan and Rodrik, 2011). While the region's labor force has been shifting out of agriculture (McMillan and Harttgen, 2014), they have not found employment in sectors associated with high productivity growth. Instead, they relocated to market services. While these had above-average productivity levels at the time, they are also generally associated with low productivity growth (de Vries et al., 2013).

An additional point to keep in mind is that growth in Sub-Saharan Africa depends on growth elsewhere. Easterly (2001), for instance, speculates that the growth slowdown observed in developing countries during the 1980s and 1990s is largely due to a concurrent slowdown in the developed world. Growth rates in Sub-Saharan Africa today depend also on growth elsewhere, particularly growth in China, and recent studies have suggested that a deceleration in the near future is very likely (Pritchett and Summers, 2014). The reason cited for this is the same as the one that we cited for a slowdown in ARRs—growth rates show an even higher degree of mean reversion.

There are already clear signs of a slowdown in economic growth in Sub-Saharan Africa. A recent report by the World Bank cites a number of external factors—the end of the commodity super cycle, the slowdown in growth in China, and a tightening of global financial conditions—as well as some domestic issues such as power supply bottlenecks—as factors contributing to a recent slowdown in overall growth from 4.6 percent in 2014 to 3.7 percent in 2015 from (World Bank, 2015). It also notes that some countries seem to be bucking the regional trend due to investment in large-scale projects. But it is far from clear whether most governments will manage to implement reforms that will make their economies resilient against strong external headwinds.

5.2 What health policies for future progress?

An important question in the context of our investigation of the usefulness of the newly proposed under-five mortality-goal is what kind of policies and interventions future reductions in under-five mortality will require. We argue that (1) much of the low-hanging fruits may have been reaped, that (2) future progress is going to depend on an increased focus on health interventions that require greater state *capacity* (or strength) as opposed to *scope*, and that (3) such activities have historically been found to be harder to bring about in terms of the time required to implement them.

Table 6 tabulates levels and changes in selected health indicators between 2000 and 2012 for which aggregate data for Sub-Saharan Africa were available from the World Bank. We classify indicators according to whether they are related to vaccination campaigns, infrastructure investment, or health service use and report figures in this order from top to bottom. What matters for future progress in terms of avoiding premature child deaths is arguably the change in the percentage of the population covered. Therefore, current rates of coverage are an indicator of the potential of these interventions to bring about reductions in under-five mortality in the

Table 6: Levels and changes in health service utilization and health behavior in Sub-Saharan Africa, 2000 and 2012.

	2000	2012	Difference
Vaccinations			
DPT (% of children ages 12–23 months)	51.5	71.9	20.4
BCG (% of one-year-old children)	68.1	80.1	12.0
Measles (% of children ages 12–23 months)	52.7	72.1	19.4
Infrastructure			
Improved water source (% of population with access)	54.7	65.0	10.3
Improved sanitation facilities (% of population with access)	25.4	28.7	3.3
Service use			
ARI treatment (% of children under five taken to health provider)	39.3	48.9	9.6
Births attended by skilled health staff (% of total)	41.7	50.0	8.3
Health behavior			
Exclusive breastfeeding (% of children under six months)	30.0	40.0	10.0

future.[15] For most interventions, the cost of a marginal increase in coverage will be increasing in the proportion covered as it requires extendind the intervention to difficult-to-reach groups. This could be because of geographic remoteness or because education levels among marginalized groups tend to be lower and, hence, the

Health interventions differ in terms of what kind of institutional environment has to be in place in order for them to be effective. Some interventions require resources but little government capacity. One-shot vaccines and the distribution of insecticide-treated bed nets (ITNs) against malaria which do not require highly-skilled health personnel are prime examples (Fukuyama, 2004). There is evidence that these interventions account for a large share of the decline in under-five mortality in Sub-Saharan Africa: from table 6, much progress has been made in vaccination coverage recently in Sub-Saharan Africa. And a large effect of these changes on under-five mortality is very much in line with recent studies that disaggregate declines in premature mortality by cause of death: Norheim et al. (2015) find that (age-standardized) deaths from vaccine-preventable diseases (diphtheria, pertussis, tetanus, poliomyelitis, and measles) have been decreasing at a rate of about two-thirds per decade, much higher than the decreases in rates for the other causes of death they study. A study by Liu et al. (2015) finds that about 47 percent of the reduction in under-five mortality stems from lower mortality due to pneumonia, which is strongly associated with many vaccine-preventable disesases, diarrhea, and measles.

There is also some evidence that the distribution of ITNs accounts for a large portion of the decline in infant mortality in some areas. For instance, Demombynes and Trommlerová (2012) report that the percentage of children under five protected through ITNs by night in Kenya has

[15] We simplify to some extent. Even with full coverage there may be technological advances such as more effective vaccines and longer-lasting bed nets that may bring about further gains.

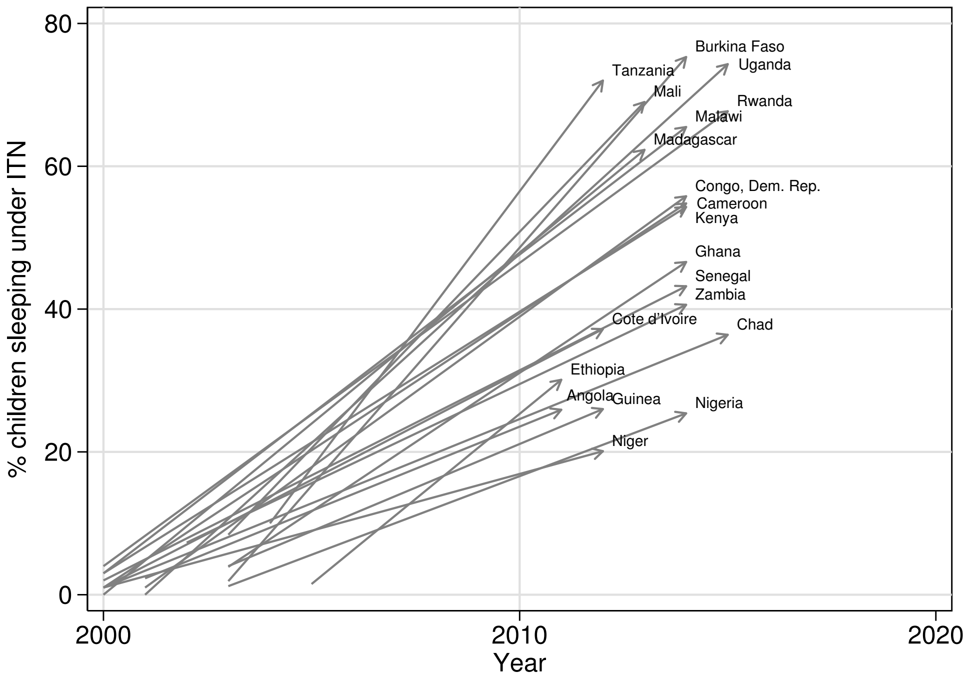

Figure 7: Increase in percentage of under-five population that uses insecticide-treated bed nets. To avoid over-populating the graph we include only countries in Sub-Saharan Africa with populations in excess of 10 mio. in 2010 and only those that had at least one data point before 2005 and at least one data point after 2010. We then plotted changes between the first data point for each country and the most recent data point.

increased from eight to 60 percent between 2003 and 2008. They show that this increase may account for half of the decline in infant mortality over the same time period. As figure 7 shows, large increases in the use of ITNs were common in Sub-Saharan Africa over the last 15 years and have almost always started from very low levels. Overall, it is thus very plausible that high rates of economic growth in combination with readily-available, low-cost, and low-tech interventions account for much of the recent decline in under-five mortality rates in Sub-Saharan Africa.

Both vaccination coverage and the use of ITNs are now at comparatively high levels and increasing coverage further may be increasingly costly. Future progress may thus have to stem primarily from interventions aimed at improving infrastructure (e.g. access to safe drinking water) and up-take of health-related services (e.g. births delivered through skilled health staff and neonatal care), which are still at lower levels. What is required to bring about improvements in these fields? Very likely, they will require substantially higher government capacity. Examples are legion: consider small-scale infrastructure projects to improve water quality at the point-of-use. These are highly effective in preventing diarrhea in children (Clasen et al., 2007) which, in turn, is the second leading cause of death in children under five (WHO, 2014). The lack of safe drinking water also contributes to the spread of water-borne diseases. But the sole construction of wells, a prime activity of governments and external development agencies in recent years, is only the first step. Wells require frequent maintenance and sometimes repair which, in turn, requires some technical know-how and the capability to provide such public goods. Surveys of the functionality of wells in Africa and other developing regions frequently find that a large number is in need of repair. For instance, Miguel and Gugerty (2005) use data on wells constructed with the assistance of the Finnish government in Western Kenya. As is common in such projects, foreign assistance was limited to the construction of the wells and provision of the equipment required for operation while actual maintenance was the responsibility of local well committees. Despite the importance of access to safe drinking water, they report that only 57 percent of these wells were fully functional in 2000/2001, suggesting wide-spread failures of local collective action in well maintenance. Such projects are therefore a prime example of interventions that require some capacity in order to be sustainable.

Government capacity is also key to a functioning health care system, in turn a prerequisite for high levels of up-take. Table 6 tabulates levels and changes in the proportion of children with acute respiratory infections (ARIs) taken to a health provider and the proportion of births attended by skilled personnel. These figures suggest that there is still room for improvements in the future through changes in health-seeking behavior. The administration of anti-retroviral drugs are another point in case. These must be taken in complex doses over lengthy time periods. Effectiveness thus requires a strong public-health infrastructure and matching administrative capacity (Fukuyama, 2004).

However, the quality of health services in many developing countries is often poor. Based on data on medical care quality from four developing countries Das et al. (2008) find that not only is the competence of doctors in these countries low. Doctors also exert less effort and thus do not bring to bear what little knowledge they have. In Tanzania, for instance, doctors complete only 24 percent of the essential checklist when faced with a patient with malaria and only 38 percent when the patient is a child with diarrhea (Leonard and Masatu, 2007). Similarly, Reyburn et al. (2004) find less than half of all patients treated for malaria in hospitals in northeast Tanzania were actually suffering from malaria.

South Africa is another case in point. The country has comparatively high levels of coverage when it comes to many routine care procedures in the area of pregnancy and birth. Yet Chopra et al. (2009) (and sources cited therein) show that the poor implementation of existing packages of care are the main reason for South Africa's lack of progress towards MDG4. For instance, a recent survey fount that even though more than 90 percent of South African women complete at least one antenatal visit, only about eleven percent received the full set of interventions required (Pattinson et al., 2007).

As long as problems with the quality of health care services persist, the effectiveness of improving treatments and increasing scope will be severely limited. Solving the kind of incentive problem that often gives rise to them will require institutional change, a challenge that while surmountable, is arguably difficult to bring about (World Bank, 2004).

6 Conclusion and interpretations

One of the major innovations of the MDG process has been the introduction of numerical targets, some of which are measurable and time-limited. This has been tainted somewhat by the insight that attaining most targets, including MDG4, was all but impossible for the poorest countries. While there is clearly an aspirational dimension involved, the combination of numerical targets with a fixed time frame strongly suggests that there is at least a small chance of attaining them. Unmet aspirations in the future may do harm in the form of finger-pointing and unrealistic targets deprive the public of a useful yardstick. Targets that have already been met by some countries at their inception may lead to disinterest in the process in these countries and a sensation of being singled out in countries far from the goalpost. Hence, if international goal-setting for the developing community is to remain a successful venture, both with respect to galvanizing support and bringing about policy changes, goals should be defined to be both ambitious *and* realistic for as many countries as possible.

Just as targets for under-five mortality defined in relative terms are starting to look more reasonable than in the past, MDG4 has been recast as a level-end goal, an absolute minimum standard of 25 deaths per 1,000 by 2030. This paper shows that this goal is overly ambitious for countries in Sub-Saharan Africa and that empirical studies that demonstrate their alleged feasibility by extrapolating from recent rates are misleading. At the same time, the new target is not relevant for all countries as many developing countries have already attained it.

It may thus be that the new goal-setters got carried away by recent progress and have now committed the same mistake as with the MDGs: having set an unrealistic mortality target for Sub-Saharan Africa.

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A List of countries in the analysis

We list here all 133 developing countries in our analysis along with the ARR (in percent) observed between 2010 and 2014 and the under-five mortality rate in 2015 (printed bold whenever it is no more than 25 per 1,000 in that year). All data come from the World Bank.

East Asia & Pacific: Cambodia (8.1, 29); China (8.6, **11**); Fiji (-0.3, **22**); Indonesia (4.4, 27); Kiribati (0.3, 56); Korea, Dem. People's Rep. (0.3, **25**); Lao PDR (4.0, 67); Malaysia (0.6, **7**); Marshall Islands (0.6, 36); Micronesia, Fed. Sts. (3.0, 35); Mongolia (7.4, **22**); Myanmar (0.3, 50); Palau (3.3, **16**); Papua New Guinea (2.2, 57); Philippines (2.3, 28); Samoa (-4.3, **18**); Solomon Islands (0.5, 28); Thailand (4.3, **12**); Tonga (-0.8, **17**); Tuvalu (2.9, 27); Vanuatu (-0.4, 27); Vietnam (2.8, **22**).

Europe & Central Asia: Albania (4.3, **14**); Armenia (5.2, **14**); Azerbaijan (5.8, 32); Belarus (9.0, **5**); Bosnia and Herzegovina (1.5, **5**); Bulgaria (4.5, **10**); Georgia (8.0, **12**); Hungary (4.9, **6**); Kazakhstan (7.9, **14**); Kyrgyz Republic (4.9, **21**); Macedonia, FYR (5.5, **5**); Moldova (3.0, **16**); Montenegro (8.5, **5**); Serbia (3.1, **7**); Tajikistan (4.6, 45); Turkey (7.4, **14**); Turkmenistan (3.1, 51); Ukraine (4.1, **9**); Uzbekistan (3.2, 39).

Latin America & Caribbean: Argentina (3.2, **13**); Belize (2.7, **16**); Bolivia (5.5, 38); Brazil (6.0, **16**); Colombia (3.0, **16**); Costa Rica (0.4, **10**); Cuba (2.3, **5**); Dominica (-3.4, **21**); Dominican Republic (1.7, 31); Ecuador (2.8, **22**); El Salvador (4.4, **17**); Grenada (1.5, **12**); Guatemala (3.7, 29); Guyana (0.6, 39); Haiti (2.6, 69); Honduras (4.2, **20**); Jamaica (1.6, **16**); Mexico (2.8, **13**); Nicaragua (3.9, **22**); Panama (2.8, **17**); Paraguay (3.3, **21**); Peru (5.4, **17**); St. Lucia (1.2, **14**); St. Vincent and the Grenadines (0.8, **18**); Suriname (3.3, **21**); Venezuela, RB (2.4, **15**).

Middle East & North Africa: Algeria (4.3, **25**); Djibouti (3.0, 65); Egypt, Arab Rep. (4.1, **24**); Iran, Islamic Rep. (6.0, **15**); Iraq (2.0, 32); Jordan (2.9, **18**); Lebanon (6.9, **8**); Libya (6.9, **13**); Morocco (4.0, 28); Syrian Arab Republic (4.2, **13**); Tunisia (5.7, **14**); Yemen, Rep. (5.8, 42).

South Asia: Afghanistan (2.6, 91); Bangladesh (6.0, 38); Bhutan (6.5, 33); India (4.3, 48); Maldives (11.5, **9**); Nepal (5.6, 36); Pakistan (1.9, 81); Sri Lanka (5.4, **10**).

Sub-Saharan Africa: Angola (2.1, 157); Benin (2.4, 100); Botswana (4.0, 44); Burkina Faso (6.7, 89); Burundi (5.2, 82); Cabo Verde (-0.4, **24**); Cameroon (3.4, 88); Central African Republic (1.9, 130); Chad (1.9, 139); Comoros (2.5, 73); Congo, Rep. (9.2, 45); Cote d'Ivoire (3.4, 93); Eritrea (4.6, 47); Ethiopia (7.5, 59); Gabon (3.8, 51); Gambia, The (3.7, 69); Ghana (2.8, 62); Guinea (4.0, 94); Guinea-Bissau (4.6, 93); Kenya (6.6, 49); Lesotho (3.5, 90); Liberia (6.9, 70); Madagascar (6.1, 50); Malawi (4.9, 64); Mali (4.7, 115); Mauritania (2.3, 85); Mauritius (0.3, **14**); Mozambique (5.5, 79); Namibia (6.0, 45); Niger (6.7, 95); Nigeria (3.9, 109); Rwanda (11.3, 42); Sao Tome and Principe (4.5, 47); Senegal (7.9, 47); Seychelles (0.0, **14**); Sierra Leone (4.5, 120); Somalia (1.5, 137); South Africa (4.0, 41); South Sudan (4.8, 93); Sudan (2.7, 70); Swaziland (5.2, 61); Tanzania (7.5, 49); Togo (2.9, 78); Uganda (7.4, 55); Zambia (6.1, 64); Zimbabwe (2.3, 71).

B Results from dynamic panel data (DPD) estimators

Table 7 presents results from more sophisticated DPD estimation methods. The models we estimate include two lags of the dependent as regressors and, in one specification, the contemporaneous growth rate of GDP per capita. The reason for this choice is that we find no evidence for serial correlation in the error terms for these specifications, indicating that the dynamics of these models are not misspecified.

As a first robustness check, we replace linear trends with time-fixed effects. This accounts for contemporaneous correlation, often the most important form of cross-unit correlation in these applications. Results from estimating these specifications via POLS are presented in columns (1) and (4) of table 7, respectively. Coefficient estimates on lagged terms are very similar to those we saw in section 3 (e.g. coefficients reported in column (3) of table 2). p-values of the Arellano-Bond-test (Arellano and Bond, 1991) suggest that there is no evidence for serial correlation of orders one through four.

One additional concern may be unobserved heterogeneity across countries. If the error term in (3.1) includes a country-specific component, POLS will usually result in upward-biased coefficient estimate for β_1 as both the dependent and its lags will be positively correlated with the composite error (Nickell, 1981). Note, however, that upward-biased estimates are conservative in our application as they would suggest less mean reversion in the data. The standard approach to deal with unobserved, time-invariant heterogeneity when panel data is available is to include country-fixed effects. However, this is usually no recipe against dynamic panel bias (Nickell, 1981; Bond, 2002). Including fixed effects is equivalent to running OLS on the de-meaned data and, by construction, the de-meaned error term will be negatively correlated with the de-meaned lagged dependent variables. The bias will be decreasing in T but since T is quite short in our case, we may expect the bias in fixed effects (FE)-estimates to be significant. Roodman (2009b) argues that reporting results from FE estimation is nevertheless useful as coefficient estimates on the lagged dependent from POLS and FE models usually provide a plausible range for the actual coefficient of interest. The same applies for the sum over coefficient estimates, an indicator of the extent of mean reversion. We report results from FE models in columns (2) and (5) and find that the estimate on the once-lagged dependent is indeed lower and so is the sum over coefficients. However, the plausible ranges implied by the POLS and FE estimates is narrow—0.27–0.47 and 0.18–0.44. Note, however, that there is evidence for higher-order serial correlation, suggesting that FE models suffer from specification problems.

We also employ GMM estimators in order to obtain consistent estimates of the dynamics of ARRs. We use Arellano and Bond's (1991) Difference-GMM estimator that relies on first-differencing for purging fixed effects and instrumenting the differenced lagged dependent with lagged levels.[16] It is often important to keep the instrument count low as too many instruments

[16] A popular alternative is System-GMM (Arellano and Bover, 1995; Blundell and Bond, 1998) but this requires that differences are orthogonal to the fixed effects. Since Sub-Saharan African countries have had both lower ARRs and have seen a large acceleration in ARRs recently, this assumption is unlikely to hold. See Roodman

Table 7: Results from DPD estimators: testing for mean reversion in quinquennial ARRs, all developing countries.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	POLS	FE	Diff-GMM	POLS	FE	Diff-GMM	Diff-GMM
ARR_{it-1}	0.60***	0.49***	0.55***	0.60***	0.46***	0.68***	0.65***
	(0.08)	(0.08)	(0.10)	(0.09)	(0.09)	(0.11)	(0.11)
ARR_{it-2}	-0.13**	-0.22***	-0.17***	-0.16***	-0.28***	-0.18**	-0.19**
	(0.06)	(0.07)	(0.06)	(0.06)	(0.07)	(0.08)	(0.08)
$GDP\ p.c.\ growth_{it}$				0.11***	0.13***	0.15***	0.15***
				(0.04)	(0.04)	(0.05)	(0.05)
$\sum_{j=1}^{L} \widehat{\beta}_j$	0.47	0.27	0.38	0.44	0.18	0.50	0.46
Time-FEs?	✓	✓	✓	✓	✓	✓	✗
Time-region-FEs?	✗	✗	✗	✗	✗	✗	✓
Observations	1,007	1,007	874	760	760	645	645
Countries	133	133		115	115		
R-squared	0.33	0.42		0.39	0.49		
Hansen-test for exogeneity of instruments:							
Degrees of freedom			1			1	1
Hansen test (p-value)			0.72			0.70	0.46
p-values of Arellano-Bond-test for serial correlation:							
$AR(1)$	0.65	0.16	0.00	0.59	0.07	0.00	0.00
$AR(2)$	0.65	0.83	0.50	0.45	0.72	0.35	0.24
$AR(3)$	0.65	0.01	0.70	0.24	0.00	0.80	0.85
$AR(4)$	0.18	0.00	0.27	0.36	0.00	0.10	0.11

Standard errors clustered around the country-level in parentheses. *, **, and *** denote significance at the ten-, five-, and one-percent level, respectively.

relative to observations will tend to result in finite sample-bias (Roodman, 2009a). Therefore, we use as instruments only the 'collapsed' set (i.e. we do not employ separate instruments for each time period) and only the second and the third lag of the dependent variable. The GMM-framework also allows us to instrument for growth in GDP per capita in the same way in order to address concerns about reverse causality. As the second lag of the dependent is also present in the main equation, this results in three external instruments for two endogenous variables.

Results are reported in columns (3) and (6). The sum over both coefficient estimates on the lagged dependent variables falls between within the range suggested by POLS and FE results when growth in GDP per capita is excluded and is only marginally above that range when it is included and treated as potentially endogenous. A one-percentage point increase in growth of per capita GDP is associated with an increase in ARRs by 0.15 percentage points in the short-run, slightly higher than in our baseline estimations. There is no evidence for serial correlation (except of order one which is to be expected after differencing) and a Hansen-test of overidentifying restrictions suggests that we cannot reject exogeneity of instruments.

Finally, we estimate a model that also includes period-fixed effects interacted with a SSA-dummy variable (column (7)). with instruments as in column (6). Hence, the model captures the extraordinary circumstances that have affected progress in Sub-Saharan Africa particularly in more recent decades. Results are very similar to what we found before. In particular, the sum over the coefficients on the lagged dependent variables is now again in the range suggested by POLS. This suggests that the POLS models that we use as the baseline adequately capture the extent of persistence in that projections in section 4 are based on. Overall, there is strong evidence that the series reverts to the long-run mean eventually.

Taken together, our results here indicate that while there is some evidence for the presence of a country-specific, time-invariant component in the error term, the resulting bias in POLS estimates is moderate. Note that using consistent estimates for projections is not an option as fixed effects are purged rather than estimated. It is important to remember that upward biased coefficient estimates and the omission of country-specific long-run means from the model only render our projections conservative in the sense that we will tend to under-estimate future under-five mortality rates in Sub-Saharan Africa.

C Alternative projections

We derive a set of additional projections that are based on regression results reported in column (4) of table 2, i.e. the model that includes the first and second lag of the dependent variable, a linear time trend, and the average rate of growth of GDP per capita over five years. We make alternative assumptions about future growth rates of GDP per capita, 3.5, 5, 6.5, and 8 percent, respectively, and calculate the share of countries in each region that would achieve an under-five mortality rate of 25 or less in 2030 (out of those that had not done so already by 2015). Results

(2009a) for details.

are reported in table 8. Note that the number of countries in the second column refers to the number of countries that had not already achieved an under-five mortality rates of no more than 25 per 1,000 and this is also the denominator in subsequent columns.

Table 8: Percentage of countries projected to achieve an under-five mortality rate of no more than 25 per 1,000 by 2030. Mean reversion model under alternative assumptions about economic growth.

		Growth rates (percent)				
	#	3.5	5.0	6.5	8.0	10.0
East Asia & Pacific	12	0.67	0.75	0.75	0.75	0.92
Europe & Central Asia	4	0.75	0.75	0.75	1.00	1.00
Latin America & Caribbean	5	1.00	1.00	1.00	1.00	1.00
Middle East & North Africa	5	0.80	0.80	0.80	0.80	0.80
South Asia	6	0.67	0.67	0.67	0.67	0.67
Sub-Saharan Africa	43	0.14	0.23	0.33	0.33	0.35

Projections are based on estimates reported in column (4) in table 2.

Results indicate that even under very favorable economic circumstances until 2030, the target would be biased against countries in Sub-Saharan Africa. Even if all countries in the region managed to bring about a growth rate of ten percent per year, a scenario that seems extremely unlikely (see section 5.1), less than two out of five countries in Sub-Saharan Africa would attain an under-five mortality rate of no more than 25 deaths per 1,000 births. The success rate is projected to be one-third if countries in Sub-Saharan Africa managed to grow at a rate of 6.5 percent per year, one percentage point higher than the growth rate recorded between 1996 and 2005 (IMF, 2014, p. 184).