



CHANGE OF PACE

ACCELERATIONS AND ADVANCES DURING THE
MILLENNIUM DEVELOPMENT GOAL ERA

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Disclosure:

The first author was involved in early policy efforts related to the MDGs in his capacity as the manager, beginning in early 2002, of the U.N. Millennium Project, the independent policy advisory body to U.N. Secretary-General Kofi Annan mandated to recommend an action plan for achieving the MDGs. Against this backdrop, this paper aims to conduct a fully independent analysis of relevant trends during the MDG period.

Disclaimer:

Source data used in this paper are being regularly updated, with potential implications for the results presented here. All findings in this paper should therefore be treated with appropriate caution as indicative and only as reliable as the underlying data. Note also that estimates of lives saved and improved are presented as falling within a range, which should not be interpreted as variants around a scientific mean, but as different point estimates based on different methodological assumptions.

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EXECUTIVE SUMMARY

Did the Millennium Development Goals (MDGs) make any difference? Perhaps no question is more important for assessing the results of global policy cooperation over the past 15 years. But this is a challenging question to answer empirically. Amid the world's complex cross-currents of economics, politics and security, pathways of cause and effect are difficult to discern. Moreover, the MDGs spoke to a wide range of policy priorities, so any findings are likely to vary considerably across issues and geographies.

Nonetheless, it is possible to conduct a quantitative investigation of trends before and after the establishment of the MDGs: Which trajectories changed where, and to what scale of human consequence? That is the main purpose of this paper. It aims to answer the “what” questions in a manner that establishes boundaries for subsequent debate about “why” some patterns shifted while others did not.

Among skeptics, there are three common critiques of the MDGs. One is that all progress was on course to happen anyway. According to this view, the MDGs were little more than a “bureaucratic accounting exercise with scant impact on reality,” according, for example, to a Financial Times editorial in September 2015. A second is that global development aggregates are driven by China and India, two very large developing countries whose progress is considered independent to multilateral system efforts. A third is that progress on development outcomes is simply a product of underlying economic growth, rather than directed policy efforts.

This paper informs an assessment of whether the first two of these critiques are correct, and thereby provides reference points to inform future investigations of the third. To our knowledge, this is the first cross-sectoral

analysis of MDG-relevant trends since the conclusion of the 2015 deadline. The results provide a reference point for efforts toward the newly established Sustainable Development Goals (SDGs) for 2030.

For each indicator, our guiding logic contrasts the amount of progress with the rate of acceleration, recognizing that different populations faced different starting situations as of the early 2000s. Countries that were experiencing slow rates of progress during the 1990s were best served if they could achieve rapid acceleration and large overall gains during the 2000s. But acceleration is a less appropriate test for countries that were already experiencing fast progress during the 1990s and merely continued their fast pace of gains to achieve significant cumulative results. In some cases it is possible that simply maintaining a rate of progress amounted to a policy victory, if factors were otherwise pushing toward a slowdown.

We structure the analysis around four substantive categories of variables: life and death issues, including child mortality, maternal mortality, HIV/AIDS, tuberculosis, and malaria; basic needs, including water, sanitation, (under)nourishment, primary education completion, and gender parity in enrollment; extreme income poverty, measured as the head-count poverty ratio; and natural capital, for which measures of forest cover and protected land area served as proxies.

One of the paper's main contributions is to apply a consistent logic across indicators while aiming to avoid analytical errors that would result from a simplistic one-size-fits-all methodology. Our core approach is straightforward. We calculate rates of progress from the pre-MDG period to establish “business-as-usual” (BAU) trajectories for each variable of interest, and then compare these with rates of progress following the establishment of the MDGs. Three quantitative assessments are

applied across indicators: simple counts of how many countries accelerated; statistical t-tests for difference in mean rates of annual progress; and bottom-up calculations of the number of incremental lives saved or improved (or not) due to accelerations (or decelerations) in progress. We apply the tests separately to countries by regional grouping and initial income classification.

We tweak methods where appropriate, based on the substantive nature of each issue and the availability of historical data. For example, we do not test for accelerations in progress on malaria deaths among countries that did not have a significant malaria problem as of 2000. Similarly, we exclude countries from tests for acceleration on access to drinking water if they already recorded universal access as of the launch of the MDGs. The composition of each indicator's pre-MDG reference period depends on data availability. At one end of the spectrum, child mortality and maternal mortality have extensive time series that permit consideration of a range of pre-MDG reference periods. At the other end of the spectrum, country-level data for antiretroviral therapy for HIV/AIDS are not reliably available for the 1990s so we calculate trends from 2000 to 2002 as an approximate pre-MDG baseline. All results are presented with the strong caveat that data quality remains highly variable across indicators.

Findings

Our results show that much of the world's post-2000 accelerations in progress occurred in low-income countries (LICs) and in sub-Saharan Africa (hereafter Africa). Meanwhile, middle-income countries (MICs) and the rest of the world, outside of China and India, typically registered larger gains but less acceleration. Life and death issues had the most substantial overall advances in the poorest countries. Among basic needs indicators, the story is more mixed. Improvements in

primary school completion rates markedly accelerated in much of the developing world. On undernourishment, countries saw an average acceleration in progress, although not in many of the most populous countries. Water and sanitation both experienced a general continuation of business-as-usual trends. Gender parity in education made considerable progress in many countries, although data gaps inhibit robust comparisons across countries and over time. Environmental indicators such as area under forest cover saw limited gains and, in much of the world, retrogression.

The trends are partly captured in Table E.1, which presents t-test results for statistically significant differences in average country rates of progress before and after the launch of MDGs. The table conveys—for each region and initial income group—the extent to which a typical country in each group experienced an acceleration in progress compared with the pertinent pre-MDG reference period. Blue boxes indicate a faster average annual rate of progress post-2000 and orange boxes indicate a slower rate. A positive (+) or negative (-) symbol signifies a sizeable shift, defined as at least a 1 percentage point change in annual proportional progress for child and maternal mortality, or a 0.33 percentage point change in annual absolute rates of progress for other indicators. Empty cells reflect no statistically significant average change in rates of progress.

The results show that both LICs and African countries had positive acceleration on most indicators. The results for child mortality are particularly striking: Both LICs and African country subgroups experienced an average jump of more than 2 percentage points per year in their rates of progress, compared with the 1990s. Meanwhile, Latin America and the Caribbean sustained a slowdown on child mortality gains, and also on access to water and access to sanitation, albeit from much better starting points as of 2000.

Table E.1. Changes in average country rates of progress, 1990-2000 versus 2000-2015

	By Income Group			By Geography					
	All Developing	Low-income	Middle-income	East Asia & Pacific	Europe & Central Asia	Latin America & Caribbean	Middle East & North Africa	South Asia	Sub-Saharan Africa
Life and Death	+	+			+				+
		+							+
Basic Needs	+	+	+	+	+	+		+	+
Undernourishment	+	+							+
		+							+
									+
Income poverty	+				+				
Natural Capital									

 faster progress
  slower progress
  limited data coverage
  +/– major change in rate

Notes: (1) Shaded boxes indicate statistically significant difference ($p < 0.05$) of mean annual rates, pre- versus post-MDG adoption. The “+” and “-” symbols indicate a large change in rates, defined as >1 percentage point change in annual proportional progress for child and maternal mortality, or >0.33 percentage point change for annual absolute progress for other indicators. (2) AIDS treatment coverage compares rates of progress from 2000-2002 versus 2002-2015. (3) Extreme income poverty results based on very limited available data: 11 low-income countries and 25 middle-income countries.

Sources: Authors' calculations based on UN-IGME(2015), World Bank (2016c).

More generally, the developing world was already making steady aggregate gains on some issues, such as hunger and access to drinking water, prior to the establishment of the MDGs, and many trends tended to continue at a similar pace post-2000. LICs did register a statistically significant average acceleration on both water and on sanitation, but the difference was 0.1 percentage points per year, which adds up to a 1.5 percentage point difference from BAU trajectories after 15 years.

Results for extreme income poverty in Table E.1 are presented in lightly shaded boxes to signify the limited data availability. Only 36 countries have adequate time series to compare pre- and post-MDG rates of progress. This includes 25 MICs, which recorded average acceleration on poverty headcounts of 0.62 percentage points per year, and 11 LICs, which recorded somewhat greater but not statistically significant acceleration.

Among the issues analyzed, the clearest shortcomings during the MDG era, which we generally benchmark as the period from 2000 to 2015, were in the realm of natural capital and environmental sustainability. At the global level, the 2010 target for reversing biodiversity loss was not achieved. Less than half the countries improved their rate of progress in protected land area and only 37 of 150 countries recorded slight accelerations in expanding area under forest cover, but the differences were mostly small. On the whole, developing countries lost more than 700,000 square kilometers of forest cover between 2000 and 2015.

Human consequences of progress

Changes in country-level trajectories can be aggregated up to calculate rough estimates of the resulting numbers of incremental lives saved and improved. Figure E.1 synthesizes the relevant findings. The foremost result is that an estimated range of 21.0 million to 29.7 million additional lives were saved during the MDG

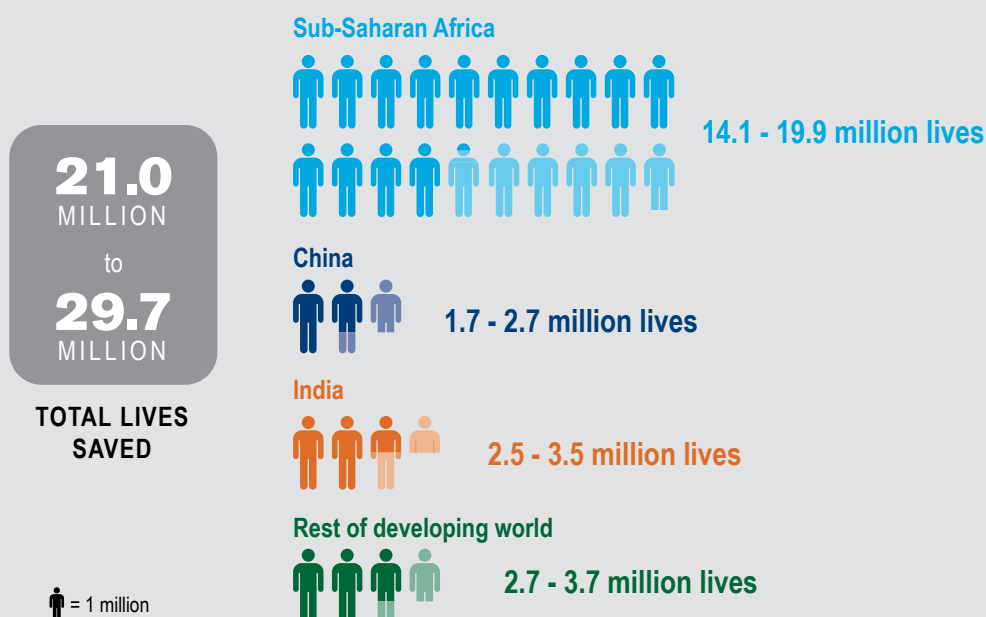
era, compared with pre-MDG trajectories. Ranges are based on whether one considers 1990-2000 or 1996-2001 as the relevant pre-MDG trend period for child mortality and maternal mortality. The figure shows that Africa was responsible for roughly two-thirds of the overall figure, at least 14.1 million lives. China and India were together responsible for only approximately one fifth of the total.

Most of the overall lives saved are due to accelerated progress in child mortality, responsible for an estimated 8.8 million to 17.3 million lives saved, plus breakthroughs in treatment for HIV/AIDS, responsible for another 8.7 million lives. Reductions in tuberculosis deaths account for an estimated 3.1 million deaths averted and faster progress on maternal mortality led to another 0.4 million to 0.6 million lives saved.

Figure E.2 presents similar calculations for lives improved on various basic needs, indicating the breakdown between China, India, sub-Saharan Africa, and the rest of the developing world. The results for drinking water, sanitation, and undernourishment are less sanguine. Although a large number of countries experienced accelerated gains, as indicated above, many populous countries experienced deceleration, resulting in aggregate estimates of incremental lives affected that are either negative or so small as to be indistinguishable from zero in practical terms. An estimated 99 million fewer people have water today than would have been the case if 1990s trends had continued, and 169 million fewer people would have been undernourished. For sanitation, China, India and sub-Saharan African countries each recorded modest incremental gains while the rest of the developing world went through an aggregate slowdown.

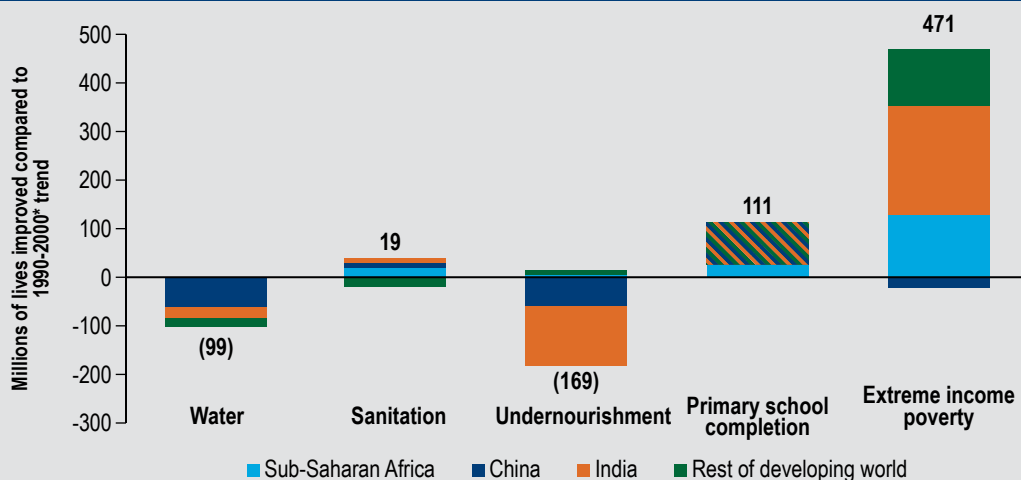
Primary school completion rates have much more positive results. An estimated 111 million more people had

Figure E.1: Total lives saved between 2000/2001 and 2015 due to accelerated progress



Sources: Authors' calculations based on UN-IGME (2015), World Bank (2016c), WHO (2016b), UNAIDS (2016b, c).

Figure E.2: Millions of lives improved as of 2015 - or not - due to accelerated progress since 2000*



Notes: For primary school completion, data do not allow for regional breakdown outside of Africa. * Years adjusted to account for data availability where needed.

Sources: Authors' calculations based on World Bank (2016b, c), U.N.-DESA (2015).

completed primary school as of 2015, compared with 1990-2000 trajectories. Around a quarter of the gains were in Africa; data gaps prevent a precise decomposition of how the other three quarters are spread among China, India and the rest of the world.

Extreme income poverty forms only a small part of our overall analysis, because head-count ratios suffer from weak country-level time-series data and rigorous counterfactuals would require complex assumptions regarding distributional patterns of economic growth within countries. Nonetheless, we do assess very basic trajectories of head-count poverty and find that most regions experienced an acceleration in reductions over the period since 2002, as also shown in Figure E.2. The exception was East Asia and the Pacific, notably including China, which had a slight slowdown from its overall fast pace of decline during the 1990s. In total, an estimated 471 million fewer people were in extreme poverty as of 2013 than would have been the case under 1990-2002 trajectories. This includes 225 million people in India, 150 million in Africa, and 119 million in the rest of the world.

Synthesis

Outcomes during the MDG period can be synthesized according to both total amount of progress and post-2000 acceleration in rates of progress. To that end, Figure E.3 synthesizes the results for LICs (excluding India) and MICs (excluding China), across the four variables where country-level data permit distillation by initial income group: child mortality, maternal mortality, drinking water, and sanitation. The horizontal axis indicates the aggregate share of each problem eliminated between 1990 and 2015, the general benchmarking horizon for most MDG targets. The vertical axis indicates the amount of post-2000 acceleration in population-weighted proportional rates of progress, compared with the 1990s. A ratio of 1 implies a constant rate of progress, while a ratio of 2 implies a doubling in the rate of progress, and so forth.

Recognizing the imperfect nature of the underlying data and hence results, Figure E.3 shows a clear pattern whereby LICs experienced greater acceleration than MICs on each indicator except access to water, while MICs achieved greater gains relative to their starting points. Figure E.4 shows results for Africa alone and

Figure E.3: Acceleration versus progress during the MDG era, by initial income group

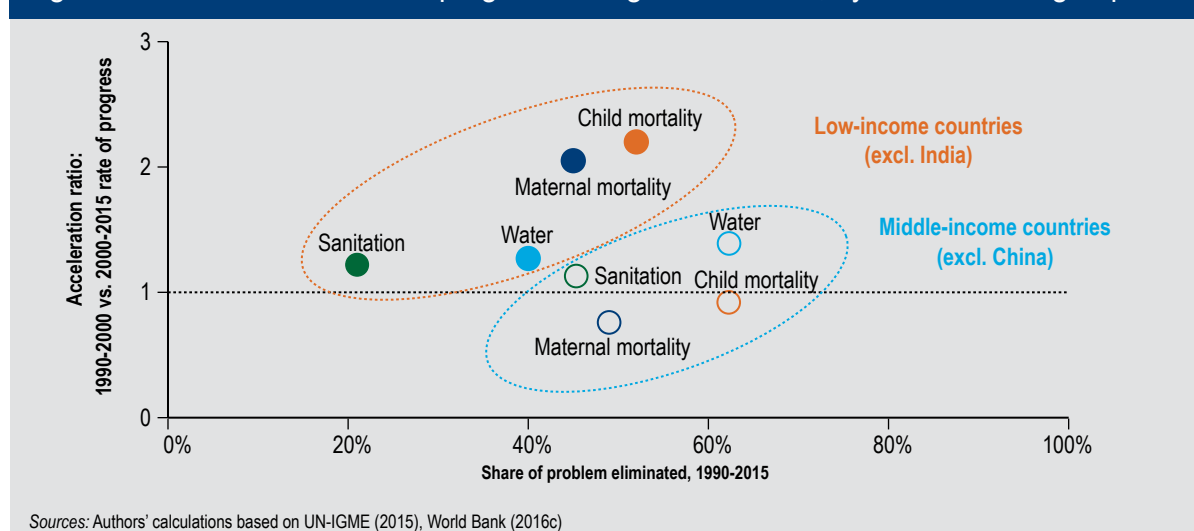
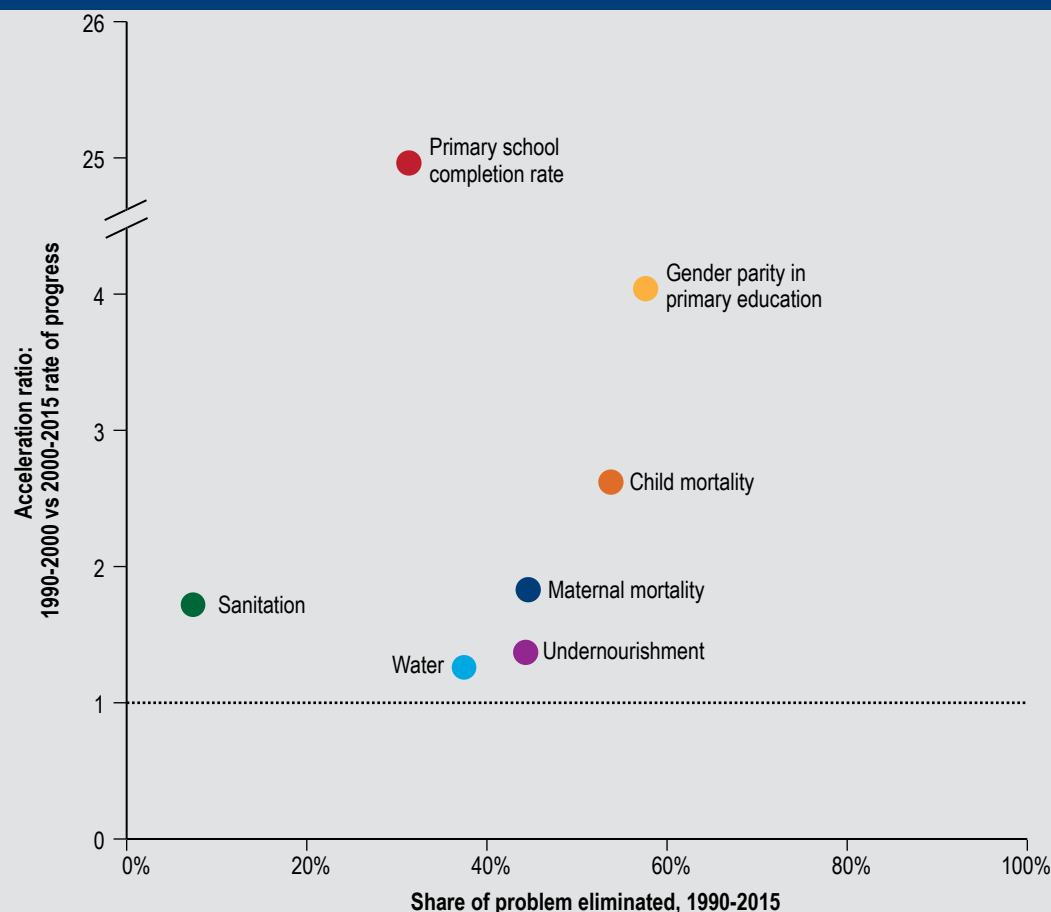


Figure E.4: Sub-Saharan Africa – widespread acceleration

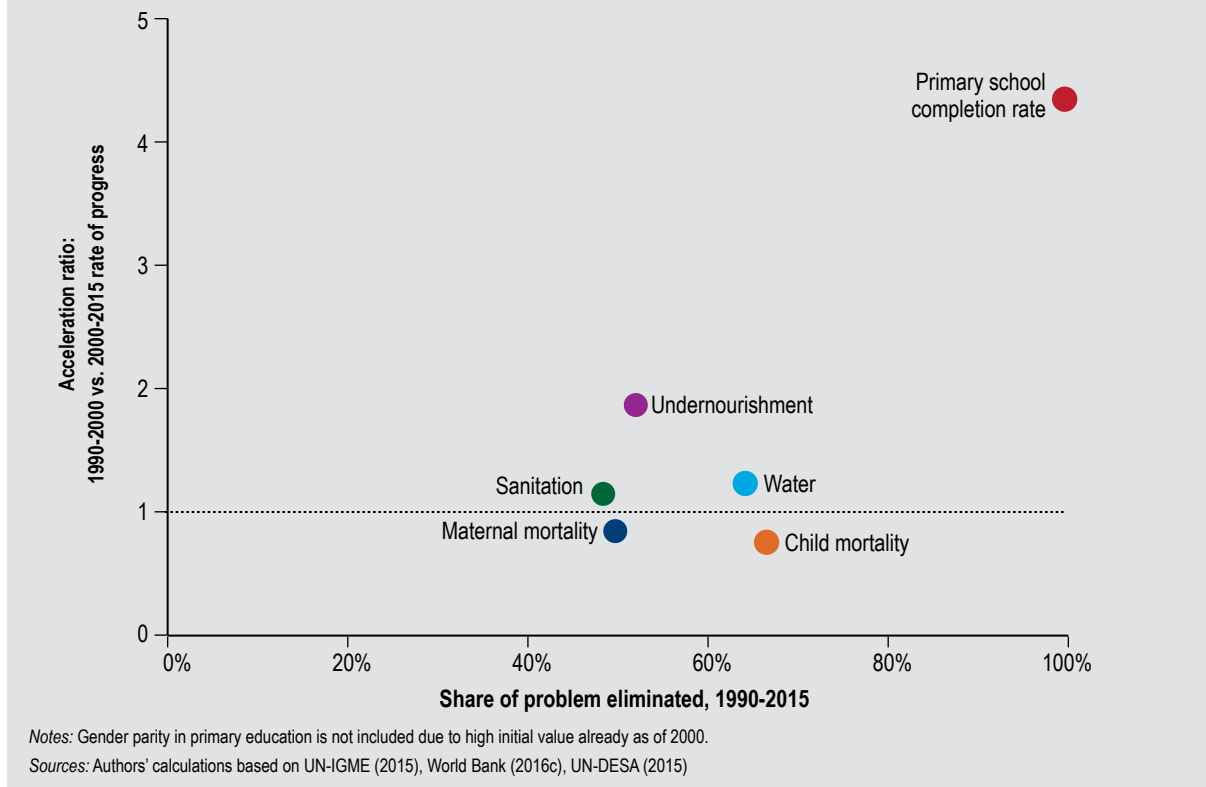


Sources: Authors' calculations based on UN-IGME (2015), World Bank (2016c), UN-DESA (2015)

also includes region-specific calculations for undernourishment, gender parity in primary education, and primary school completion. Progress in reducing child mortality again shows very positive results in Africa, although primary school completion is the indicator with the most significant acceleration in the region; the vertical axis is truncated to account for the dramatic shift, with a 25-fold improvement in the rate of progress, following near zero annual progress during the 1990s. More disconcertingly, only 7 percent of Africa's access to sanitation problem was addressed between 1990 and 2015, even as the rate of progress nearly doubled.

Patterns of progress differed considerably across regions. For example, Figure E.5 presents a synthesis for Latin America and the Caribbean. The graph shows many dots on the right half of the graph, indicating large relative gains, but most are vertically concentrated near the dotted line indicating no change in the rate of progress. The notable exceptions are undernourishment and primary school completion, which had accelerations in the proportional rate of progress as the respective problems got closer to elimination. Meanwhile, both child mortality and maternal mortality experienced modest slowdowns com-

Figure E.5: Latin America and the Caribbean – major gains, less acceleration



pared to the region's relatively high rates of progress during the 1990s.

Implications

Our results highlight the 2015 outcomes that were not on track to happen as of 2000. They also show that China and India have not been the overwhelming drivers of acceleration, whereas African and low-income countries often have been, especially on matters of life and death.

The global variations in absolute amounts of progress and accelerations in rates of progress prompt questions as to what drove the differences, especially among low-income countries. If one presumes, for ex-

ample, that economic growth is the primary driver of outcomes, then one would need to substantiate how the same underlying patterns of growth led to such different trends across outcomes such as HIV/AIDS deaths, child mortality, primary school completion, and access to drinking water. Conversely, if one believes that official development assistance is a primary driver of particular outcomes in low-income environments, then one would need to substantiate the links between issue-specific outcomes and relevant forms of public and private finance.

The range of results across sectors also draws attention to the role of institutions and policy communities. The field of global health, for instance, underwent a major expansion of leading international public in-

stitutions, private philanthropy, and active scientific research during the MDG period, backed by major increases in public financing and bolstered by ongoing applied research debates in *The Lancet* and other prominent journals. At the same time, the evidence prompts questions regarding which institutions, if any, had corresponding responsibilities for outcomes in areas that achieved less acceleration in progress—such as undernourishment and sanitation.

Finally, the analysis draws attention to inherently complex notions of public responsibility. When the world sets goals such as the MDGs—or now the Sustainable Development Goals—who is responsible for each

component that feeds in to progress, ranging from research to evaluation to advocacy to financing to policy design to implementation? Who should be congratulated when complex systems generate unprecedented outcomes? Who should be accountable when populations fall short? Who should be held responsible for the adequacy of data even to assess progress?

This study's results help to inform assessments of how and where the world's patterns of progress changed pace during the MDG era. Some of the shifts were dramatic. Learning from them is crucial for generating the world's next batch of needed breakthroughs.

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I. INTRODUCTION

Did the Millennium Development Goals (MDGs) make any difference? Perhaps no question is more important for assessing the results of global policy cooperation over the past 15 years. But this is a challenging question to answer empirically. Amid the world's complex crosscurrents of economics, politics, and security, pathways of cause and effect are difficult to discern. Moreover, the MDGs spoke to a wide range of policy priorities, so any findings are likely to vary considerably across issues and geographies.

Nonetheless, it is possible to conduct a quantitative investigation of trends before and after the establishment of the MDGs: Which trajectories changed where, and to what scale of human consequence? That is the main purpose of this paper. It aims to answer the “what” questions in a manner that establishes boundaries for subsequent debate about “why” some patterns shifted while others did not.

Among skeptics, there are three common critiques of the MDGs. One is that all progress was on course to happen anyway. According to this view, the MDGs were

little more than a “bureaucratic accounting exercise with scant impact on reality,” according, for example, to a Financial Times editorial in September 2015. A second is that global development aggregates are driven by China and India, two very large developing countries whose progress is considered independent to multilateral system efforts. A third is that progress on development outcomes is simply a product of underlying economic growth, rather than directed policy efforts.

This paper informs an assessment of whether the first two of these critiques are correct, and thereby provides reference points to inform future investigations of the third. To our knowledge, this is the first cross-sectoral analysis of relevant trends since the conclusion of the 2015 MDG deadline. The results provide a reference point for efforts toward the newly established Sustainable Development Goals (SDGs) for 2030.¹

The basic logic of the analysis is presented in Figure 1.1, which distills four types of stylized outcomes for each MDG issue. The horizontal axis indicates the amount of progress achieved between 1990 and 2015, the benchmarking horizon for most MDG targets. The vertical axis indicates the degree of acceleration after

the launch of the MDGs subsequent to the 2000 UN Millennium Summit. On the bottom left, quadrant C straightforwardly represents the worst-case outcome: little progress and little acceleration in the rate of progress. On the top right, Quadrant B indicates a clearly positive outcome of large absolute gains and significant acceleration in the rate of progress. However, Quadrant B is not necessarily a better outcome than Quadrant D, on the bottom right, which reflects a considerable amount of progress but little acceleration. It is possible, for example, that a pre-MDG rate of progress on an indicator was already fast and that this trend simply continued to 2015. It is also possible that maintaining a pre-existing rate of success would have amounted to a policy victory of its own, if factors were otherwise pushing toward a slowdown.

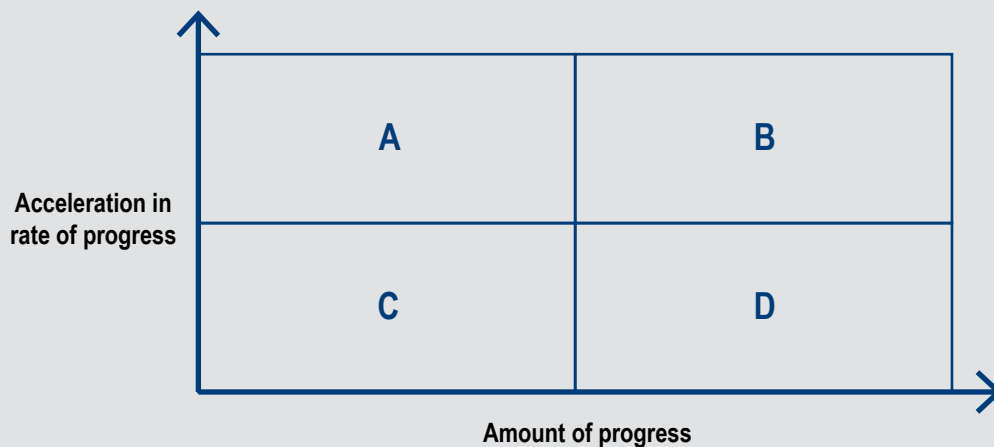
Similarly, the top left portion in Figure 1.1, Quadrant A, does not necessarily reflect a worse outcome than Quadrant B. Greater absolute gains over any period are certainly preferable, but it might still represent a major breakthrough to initiate accelerated progress after a long period of stagnation or even decline. It is

also not necessarily the case that outcome A is better or worse than the overall gains under outcome D. The tension between progress and acceleration frames a central nuance for interpreting results achieved over the MDG period.

To stress, we do not attempt any statistical tests of causality, so this study should not be interpreted as a formal assessment of MDG impact. As discussed in the supplementary online appendix (Appendix 3), it is not clear how the MDGs should even be defined as an explanatory (right-hand side) variable, and it is difficult to discern all the pathways through which the MDGs might have played either a direct or indirect role in changing trajectories. The results in this paper aim to provide a starting point for more in-depth quantitative and qualitative assessments of such questions.

Specifically, trend data can be parsed to differentiate among outcomes and rates of progress across targets and geographies. This makes it possible to identify, at one end of the spectrum, cases where there was clearly no dent in business-as-usual trajectories during

Figure 1.1: Acceleration versus progress – a stylized matrix of MDG outcomes



Source: Authors.

the MDG period, even if there might have been policy successes helping to avoid a slowdown. At the other end of the spectrum, it is possible to identify cases where trajectories did change among relevant populations. In those instances, even if it is not possible to prove statistically that the MDGs caused specific outcomes, it is possible to reject arguments postulating that nothing changed during the MDG era.

The paper dedicates considerable attention to indicator-specific methodological choices, so one of its main contributions is to apply a consistent logic across issue areas while aiming to avoid analytical errors that would inadvertently result from a simplistic one-size-fits-all methodology. The core data sample focuses on developing countries, in line with the intent of the MDGs. The analysis differs from previous studies in three key respects.

- First, it segments relevant MDG targets by type. We give separate consideration for “life and death,” “basic needs,” “extreme income poverty,” and “natural capital” categories of indicators.
- Second, we assess post-2000 acceleration in multiple ways: by comparing each country’s before-and-after rates of progress; by conducting basic t-tests for average difference of cross-country rates of progress among different subgroups; and by translating changes in rates

of progress into estimates of incremental lives saved or improved.

- Third, we tweak indicator-specific methods where needed, based on the substantive nature of the issue under consideration and the availability of historical data. For example, we do not test for accelerations in progress on malaria deaths among countries that did not have a significant malaria problem as of 2000. Similarly, we exclude countries from tests for acceleration on access to drinking water if they already recorded universal access as of the same year. And if country time-series data are not available for the 1990s, as is the case for malaria deaths, we use early 2000s rates of progress as a baseline trend.

Readers less interested in the technical issues for each indicator might wish to jump straight to the synthesis of the findings presented in Section V. A glossary of key terms is presented in Box 1. Those with a more technical bent might wish to follow the full argument: Section II reviews previous relevant studies. Section III describes our data sources and methods. Section IV then presents the main findings, proceeding in a step-wise fashion through each issue category. This section is somewhat lengthy, while distilling more comprehensive results as available in the appendix. Following the synthesis of Section V, a final section concludes.

Box 1: Glossary

Acceleration and deceleration: A measure of whether a rate of progress speeds up or slows down over time. Note that this is different from an absolute measure of progress (movement toward a goal) or retrogression (movement away from a goal).

BAU—Business as usual: A term used to describe a stable ongoing trajectory and underlying rate of change from one time period to the next.

Counterfactual scenario: An assessment of events as might have occurred if a particular underlying assumption is altered. In this paper, Counterfactual A examines how indicators would have evolved if average trends from the entire 1990s had continued past 2000 and on to 2015. Counterfactual B examines how indicators would have evolved if average trends from 1996 to 2001 (or thereabouts, depending on the indicator) had continued unchanged to 2015.

T-test: A test commonly used to determine whether the average values of two groups of data are different in statistical terms. Imagine, for example, an indicator on which the average rate of progress across 100 countries was 2.0 percent per year during the 1990s, then the average rate of progress across the same 100 countries is slightly higher, 2.4 percent per year, during the 2000s. The t-test tells us whether the difference of 0.4 percentage points is “real” in statistical terms.

Kernel density: Similar to a bell curve, this is a way to view, in visual terms, how frequently different values appear for a particular variable. In this paper, curves are used to illustrate the distribution of countries’ rates of progress and how these rates might shift over time. In statistical terms this is a method of estimating the frequency of a variable across a range of values, based on a specific data sample.

II. PREVIOUS STUDIES

Several earlier studies have considered progress on MDG-relevant metrics. This includes multiple health-focused articles in *The Lancet*. For example, You et al. (2015) estimated annual under-5 child mortality rates (hereafter simply CMR) for 195 developed and developing countries from 1990 to 2015. These estimates formed the basis for the U.N.'s Inter-agency Group for Child Mortality Estimation publication (U.N.-IGME 2015). In their study, You et al. found that more than half of all countries, including 90 percent of countries in sub-Saharan Africa (hereafter Africa), experienced acceleration in gains post-2000. These estimates build on an earlier assessment by Wang et al. (2014), who found acceleration in 99 of 188 countries, including a large majority in Africa, since 2000.

You and colleagues estimate that 18 million incremental children's lives were saved compared with 1990s trajectories, by implementing a counterfactual methodology previously presented in McArthur (2014). The latter paper also found that rates of progress on CMR accelerated in 91 percent of African countries and 82 percent of initially low-income countries, even when framing a slightly more conservative benchmark of comparing rates of progress from 1996 to 2001 to those from 2002 to 2013. Meanwhile, CMR declines accelerated in only 47 percent of middle-income countries from their already higher rates of average progress in the late 1990s.

For maternal mortality ratios (MMR), Kassebaum et al. (2014) presented estimates for 188 countries and used them to test for acceleration in annual rates of change between two periods: 1990-2003 and 2003-2013. They found that 70 percent of all countries (again, both developed and developing) experienced acceleration in gains, including 42 of 48 countries in Africa. Across all countries, they found the annual rate of decline in-

creased from 0.3 percent in 1990-2003 to 2.7 percent after 2003.

Other earlier studies examined different combinations of MDG-linked variables over different time periods. Fukuda-Parr et al. (2013) assessed 25 MDG-related indicators for all developed and developing countries over the period 1990 to 2010. Their primary assessment calculated whether each country experienced post-2000 acceleration relative to a linear percentage point rate of change. For child mortality, a supplemental calculation assessed acceleration based on an annual proportional rate of change. (The difference is described in Section III below.) The authors reported subsets of results for Africa and for the 48 least developed countries, finding evidence that a majority of countries in these groups had accelerated gains for 16 and 13 out of 25 indicators, respectively. These positive results included measures of child mortality, income poverty, and sanitation, among others.

Kenny and Sumner (2011) examined progress across several MDG variables up to 2008 and 2009, i.e., slightly more than the first half of the MDG period. For a subset of four indicators—primary education, gender equality, child mortality, and maternal mortality—the authors constructed long-term curves that fit country-level observations up to 2008 or 2009 and then assessed the extent to which the most recent values (in some cases extrapolated to 2010) deviated from the curve. They reported notable aggregate accelerations for primary education, maternal mortality, and gender equality in primary enrollment, alongside a modest acceleration for child mortality.² In looking at global aggregate data, they also found evidence of an acceleration in the rate of extreme poverty reduction between 2003 and 2008 compared with 1990 to 2001-2002, but no evidence of faster progress on undernourishment or access to drinking water over the same periods.

Two analytical points are worth noting for the child mortality findings in Kenny and Sumner. One is that the paper's reported values of actual developing country CMR in 2009 do not match the underlying source data published at the time.³ The discrepancy appears to be the result of an aggregation methodology that weights country-level values by population rather than by number of births, the latter being the appropriate match when scaling a variable with a denominator measured in births. A second point, beyond the control of the authors and with considerable consequences for interpreting long-term trends, is that official estimates of under-5 mortality rates during the early 2000s were substantially revised after the working paper's publication in 2011. For example, the latest 2015 U.N. data release suggests that the aggregate developing country CMR value for 2009 was not 66 per 1,000 live births, as originally estimated in 2010, but a much lower 58 deaths.

The significant nature of the CMR historical data revisions underscores the need for generalized caution when interpreting results related to all indicators presented in this paper. Nonetheless, if we consider the most recent U.N.-IGME data set to be the best available source for CMR, we can use it to replicate Kenny and Sumner's baseline methodology while correcting for birth weights. Doing so produces a counterfactual business-as-usual CMR estimate of 65 deaths per 1,000 live births in 2009, compared with the U.N.'s most recently reported value of 58 deaths per 1,000 live births for that year. This would suggest that, as of 2009, child mortality had declined roughly an additional 11 percent below trend lines, approximately twice as big a difference as suggested by Kenny and Sumner. The increment would only grow larger over the following six years through the 2015 MDG deadline.

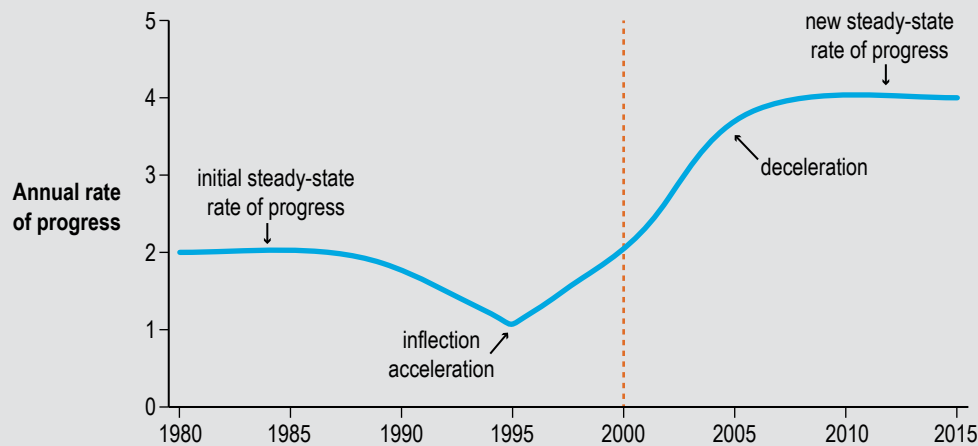
In another study, Friedman (2013) searched for discontinuities in rates of progress for 19 indicators between

1990 and 2010. He found evidence for positive post-2000 gains on debt relief, but not on other indicators. Because of data limitations, the study did not examine maternal mortality, undernourishment, or primary school completion, arguably three of the MDG's most politically salient targets. Nonetheless, the paper's core question was to test for inflection points in the rate of progress. This is an important question, but on its own it risks obscuring a better understanding of shifts in trajectories. For example, Figure 2.1 presents a stylized graph with annual rates of progress from 1990 to 2015. An inflection point would imply a point of shifting slope on the curve, from decreasing to increasing or vice versa. If an inflection point occurred in 2000 or earlier, Friedman considered that as evidence that the MDGs had no effect. However, this methodology was likely not asking the most important question.

Figure 2.1 shows how an inflection point might be identifiable during the mid-1990s, at the nadir of a period of unusually slow progress. If the question of MDG success is framed narrowly as identifying the year of an inflection point toward acceleration, then the answer would be 1995, with no positive implications for the MDGs. Indeed if one tests for changes in the rate of progress in the post-2000 period, one would also find a deceleration in the mid-2000s. But, as shown in the figure, the post-2005 steady-state rate of progress is unprecedentedly high, roughly twice as high as the previous steady-state. Statistical inflection points thereby present only partial information. A more important statistical issue in this example would be to identify and explain the new steady-state.

To be clear, the identification of a new steady-state post-2000 does not on its own imply the success of the MDGs. Conversely, if the rate of progress had been constant throughout, as Friedman indicated, that does not necessarily imply that the MDGs were not helpful, since they could have helped avoid a slowdown. In

Figure 2.1: Comparing inflection points with rates of progress



Source: Authors.

Figure 2.1, the fact that the curve is upward sloping as of 2000 indicates that acceleration in the rate of progress had already begun for some reason prior to the MDG period. However, the figure also underscores the risk of “Type II” (false negative) diagnostic errors if too narrow a statistical methodology is deployed. The data need to be considered from multiple angles.

Context is also crucial when interpreting the information provided by an individual indicator over time. Consider, for example, Friedman’s assessment of HIV/AIDS trends. The paper suggested that, for a sample of less developed countries (those classified by the World Bank as IDA and IDA/IBRD Blend),⁴ 1997 was the turning point in progress on HIV/AIDS. At first glance this might be puzzling to those who know that the world’s first lifesaving international antiretroviral treatment support program was not initiated until four years later, 2001, in the form of the Global Fund to Fight AIDS, Tuberculosis, and Malaria, which disbursed its first grants in 2003. This was supplemented with the 2003 launch of the major U.S. bilateral AIDS treatment pro-

gram. These programs helped drive unprecedented expansions of treatment during the 2000s.

The discrepancy is explained by the fact that Friedman considers HIV prevalence as the variable of interest, as Fukuda-Parr et al. also did, rather than considering measures of lives saved among people with HIV/AIDS. A major limitation of this approach is that it overlooks how the dramatically expanded availability of antiretroviral treatment affected the nature and consequences of HIV infection (and hence prevalence) over the course of the 2000s. As millions of people began receiving access to treatment, HIV infection shifted from being a death sentence to a treatable disease, and international AIDS targets were revised to be more ambitious at multiple junctures during the MDG period. Therefore indicators of HIV incidence and prevalence do not provide adequate information on whether someone lived or died from an infection, and offer a very narrow segment of the global HIV/AIDS story since 2000. To that end, our own analysis in this paper focuses on measures of lives saved and the number of people to receive lifesaving treatment.

III. DATA SOURCES AND METHODS

We depart from the common practice of analyzing the MDGs in numerical order from Goal 1 onward. Instead, we categorize indicators by analytical type, grouped into four categories.

- **Life and death.** This comprises under-5 mortality (MDG 4), maternal mortality (MDG 5), and deaths from HIV/AIDS, tuberculosis, and malaria (MDG 6).
- **Basic needs.** This comprises education (MDG 2), hunger (MDG 1.b, which we track via undernourishment), gender equality (MDG 3), and access to drinking water and sanitation (MDG 7.c).
- **Extreme income poverty.** Although income is often considered a basic need and poverty is most commonly discussed in terms of income, we consider extreme income poverty (MDG Target 1.a) as its own separate category. This is partly because underlying time-series data on relevant indicators are so limited at the country level, rendering it difficult to make accurate assessments of variations in underlying trends and poverty gaps. It is also because one of the underlying political motivations of the MDGs was to broaden policy attention toward human development-type outcomes like health and education, as distinct objectives alongside income growth.
- **Natural capital.** MDG Target 7.a focused on principles of sustainability and Target 7.b focused on global measures of biodiversity. These issues are difficult to measure in a common country-level form, so we assess changes in forest cover and protected land area as proxy measures.

We do not examine the macroeconomic enabling targets listed under Goal 8. Those targets were not set with quantitative benchmarks. Moreover, they can be considered intermediate inputs toward the core development outcome variables of interest under Goals 1 through 7.

1. Data

Our core sample comprises 154 of today's 193 U.N. member states that were classified by the World Bank as developing countries as of 2000. Of the 154, 65 were designated low-income countries (LICs) and 89 were middle-income countries (MICs) as of that year. We use these initial income classifications throughout the paper. Data sources and sample sizes are listed in Appendix 1. We use only official data sources, many of them aggregated via the World Bank's online World Development Indicators. Some indicators have better coverage than others. For example, the Food and Agriculture Organization of the United Nations (FAO) reports undernourishment data for only 111 of our sample countries. Although these countries together account for 92 percent of our sample population, missing observations are likely biased toward very poor countries with weak statistical systems and high undernourishment.⁵ Primary school completion has similar country-level data gaps.

As a general caveat, we are not able to vouch for the underlying data quality. Some indicators are a product of direct surveying while others represent modeled estimates. Some observations will be subject to ongoing revision, as in the case of child mortality rates described earlier. Hence all results in this paper should be interpreted with appropriate caution.

2. Methods

The specific formulas used for each of our main calculations are listed in Appendix 2. The following provides an overview of key parameters and underlying decisions driving them.

Countries of focus: The analysis focuses on developing countries' geographies, in line with the emphasis of the 2000 U.N. Millennium Declaration. We also compare trends by initial income group, since most extremely poor people still lived in low-income countries at the time. To account for the large influence that China and India have on population-weighted aggregations, we frequently separate out these two countries from aggregate calculations and present them as their own unique values. This permits us to create the categories "LICs excluding India" and "MICs excluding China." We also apply our quantitative tests to each developing region, with full results presented in Appendix 4.

Quantitative tests: Wherever possible, we conduct three assessments to compare pre- and post-MDG rates of progress. First, we simply count the number of countries that had acceleration in the annual rate of progress since the establishment of the MDGs. We also report counts for "real" acceleration, since it is possible that simple acceleration tests are capturing miniscule accelerations and random variation around long-run average rates of progress.⁶ We consider countries to be accelerating only if their post-2000 rate of progress is positive. For example, we do not consider a country to be "accelerating" progress on malaria if it merely slowed the rate at which relevant deaths are increasing, as opposed to decreasing the annual number of deaths. Second, we conduct statistical t-tests for differences in mean country rates of annual progress, independent of country size. Third, we calculate the extent to which changes in rates of

progress imply differences in overall human outcomes, measured by either incremental lives saved or improved (or not).

Time horizons: We divide the years 1990 to 2015 into pre- and post-MDG periods. Where data permit, the pre-MDG reference period is defined in two distinct ways: The first is the full decade from 1990 to 2000, and the second is the five-year period from 1996 to 2001. This shorter time window is constructed to frame potentially more conservative counterfactuals, as discussed in McArthur (2014). It allows for the fact that the MDGs did not begin to be commonly referenced until 2002, and to adjust for cases of unusually slow rates of progress in the early 1990s, after the end of the Cold War. We extrapolate trends from these respective time windows to calculate counterfactual trajectories out to 2015: "Counterfactual A" uses the 1990-2000 trends and "Counterfactual B" uses the 1996-2001 trends.

Data gaps prompt the need to adjust time period definitions on some variables. For basic needs indicators, most countries have gaps in reported year-to-year observations. To accommodate for this, we calculate a pre-MDG rate of progress for each country using its first available data point from 1990 to 1995 and then using either 2000 or 2001 (or 1999 if data gaps require it) as an end point. To calculate post-MDG rates of progress, we set either 2000 or 2001 as the starting point, as appropriate, and then calculate the rate of change through to the most recent observation reported from 2010 onward. Therefore all country-level tests for undernourishment, water, sanitation, and primary school completion consider only one pre-MDG reference period.

After this time period adjustment is made, country-level data for both water and sanitation have adequate coverage to allow aggregate assessments of lives affected by geography and by income group. However,

country-level data coverage for undernourishment and primary school completion are too limited to permit a similar method of aggregation. For these two variables, we therefore use a combination of the World Bank's annual regional and developing country aggregates, as classified in 2016, to estimate number of lives affected by geography. We are thereby able to estimate both Counterfactual A and Counterfactual B for regional undernourishment and primary school completion. Data gaps mean that we are not able to make corresponding estimates by income group.

Country-level data gaps for extreme income poverty are particularly pronounced. Only 36 countries have adequate data to compare pre- and post-2000 rates of progress, so we conduct t-tests with corresponding caution. We estimate the relevant numbers of aggregate lives affected using World Bank regional trends

before and after 2002 (a main reporting year for global figures), in addition to country-specific data for China and India.

Calculating rates of progress: We use two types of calculations to estimate annual rates of progress. In line with previous literature, we focus on the proportional rate of change for mortality indicators and the absolute percentage point rate of change for basic needs indicators.^{7,8} In some cases, we adjust the formula to align with the nature of each respective indicator. For example, we do not include countries in acceleration tests if they were within 1 percentage point of a relevant ceiling in 2000, such as 100 percent access to water, because it is not practical to identify discernible accelerations in progress in those situations. Relevant details are described in each results subsection below.

IV. FINDINGS

Here we present results by analytical category. We begin with a multistep assessment of CMR trends to illustrate the importance of multidimensional assessments of progress.

1. Life and death

1.a) Child mortality

According to official U.N. data (U.N.-IGME 2015), the CMR in developing countries dropped by more than half between 1990 and 2015: from 100 deaths per 1,000 live births to 47 per 1,000 births. Amid a growing number of total annual births over the same period, this translated into reduction from 12.5 million under-5 child deaths in 1990 to 5.9 million deaths in 2015 (U.N.-IGME 2015).

Figure 4.1 presents three ways to assess CMR trends. Panel A, at top, shows CMR levels from 1975 through 2015. At first glance, this graph might seem to suggest a fairly stable long-term decline across countries. However, it masks large year-to-year variation in the rate of change. Panel B translates the same long-term time series into annual absolute percentage point changes in CMR. The graph clearly suggests variability in the annual rate of progress, with the greatest absolute declines occurring in the late 1970s and early 1980s, followed by a slow period during the early 1990s. Gains become more positive again during the 2000s, although not as rapid as in the late 1970s.

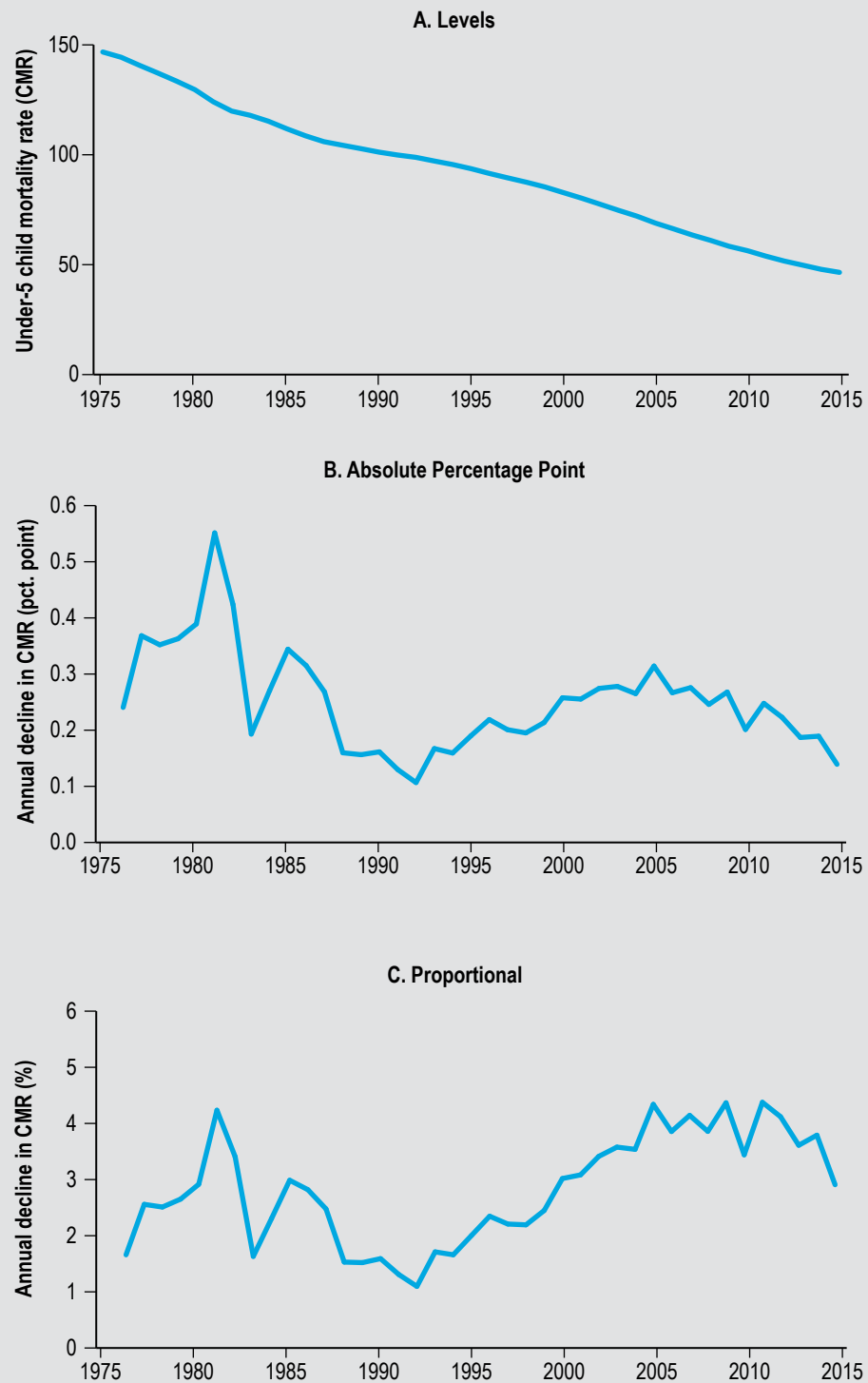
By contrast, Panel C considers the original time series in terms of annual proportional rates of change. Analytically, this is a more appropriate measure for health outcomes that are a product of a technology ladder as mortality rates get closer to zero. For example,

basic immunizations might help achieve a 20 percent reduction in child mortality from 200 deaths per 1,000 live births down to 160, but more sophisticated neonatal interventions are likely needed to achieve a similar 20 percent reduction, if smaller absolute change, from 10 deaths per 1,000 live births down to eight. In that regard, Panel C shows the same 1990s low point as Panel B, but it then indicates that the average proportional rates of progress in the 2000s were even faster than those in the 1970s and early 1980s.

Note one visual implication of Panel A in Figure 4.1 is that a constant proportional rate of change would look like a flattening (asymptotic) curve rather than a straight diagonal line, while a straight diagonal line would represent a proportional acceleration. This is illustrated in Figure 4.2, which shows the difference between constant proportional and percentage point rates of progress for a country with a starting CMR of 100 per 1,000 live births. The solid line shows that a constant 5 percent proportional annual rate of progress follows a flattening asymptotic curve. After 20 years, the CMR has declined to 35.8 per 1,000 live births. The straight dotted line shows a constant absolute reduction of 5 percentage points. In the final year the drop from five deaths per 1,000 live births to zero is equivalent to a 100 percent proportional rate of progress.

A major limitation of aggregate data is that they obscure important variations by income group and region. To that end, Figure 4.3 reframes the long-run CMR trends by considering the annual proportional rate of progress among LICs and MICs, holding aside the hugely populous countries of India and China, respectively. (Results with those two countries are included in Appendix 6.) Trends are smoothed here using three-year moving averages. The top line shows that MICs had relatively stable and high rates of average progress over four decades. This provides crucial context to the fact that only

Figure 4.1: Different perspectives for assessing the same under-5 child mortality trends

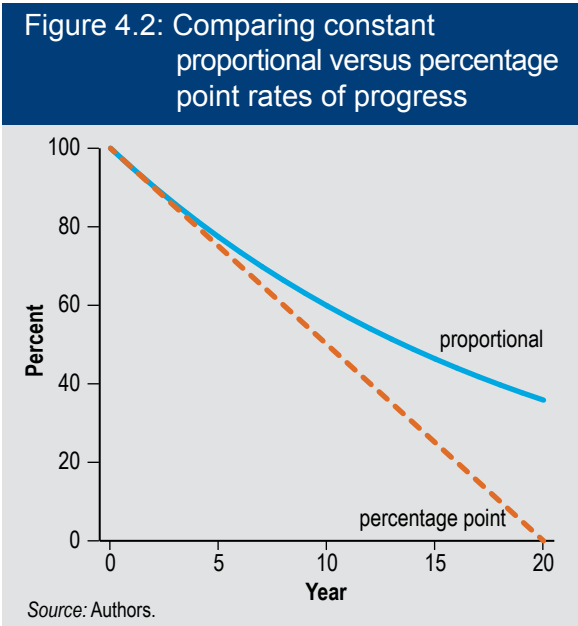


Source: Authors' calculations based on U.N.-IGME (2015).

38 of the 89 MICs (43 percent) had any acceleration in rates of progress after 2000.

In contrast, child mortality in the LICs declined by an average of only 1.7 percent per year from 1975 to

2000, with the mid-1990s as the period with the slowest rate of gains—notably in the context of much higher mortality values than in MICs at the time. From 2000 to 2015, the annual rate of progress in LICs then doubled to an average of 3.7 percent.⁹ Fifty-six of the 65 LICs accelerated rates of progress between 1990-2000 and 2000-2015, 42 of them experiencing a “real” jump of at least 1 percentage point per year.



A next layer of analysis considers the composition of changes in rates of progress. Figure 4.4 plots the kernel density of rates of progress from 1996 to 2001, shown in the solid line curves, compared with 2001-2015, shown in the dotted lines, for MICs, LICs, and Africa. We show these Counterfactual B-based comparisons as a slightly “harder” test than the Counterfactual A-based comparisons based on 1990-2000, since the all-time lowest rates of progress took place in the early 1990s. The distributions show that LICs and Africa had clear rightward shifts in the curves, while the MICs did not.

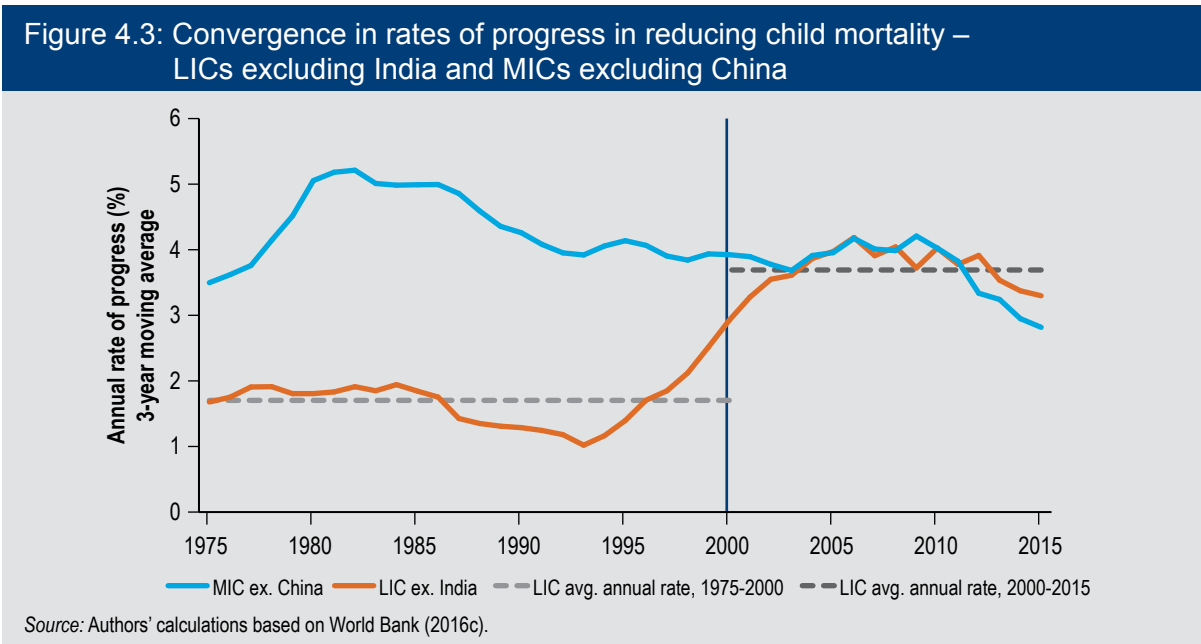
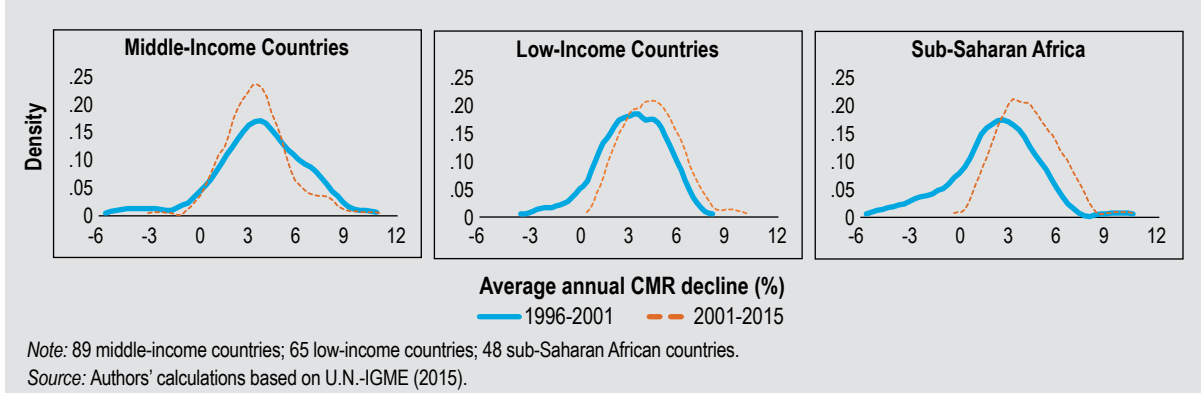


Figure 4.4: Shifting distributions of annual rates of progress on child mortality, 1996-2001 versus 2001-2015



Simple t-tests can show the extent to which typical countries experienced average accelerations in progress, independent of country size. The results for CMR are reported in Table 4.1. They indicate that LICs had a statistically significant increase in the mean rate of progress, whether comparing the 1990-2000 to 2000-2015 periods, or comparing the more restrictive 1996-2001 to 2001-2015 periods. The results also show that the annual mean rate of progress of African countries almost doubled from 2.1 percent in 1996-2001 to 4.1 percent during 2001-2015. No other region experienced significant accelerations during this period, although Latin America and the Caribbean did undergo a significant slowdown, from 3.8 percent per year in 1996-2001 to 2.8 percent from 2001-2015.

One other way to look for deeper change in the underlying nature of global progress on CMR is to test for unconditional (“Beta”) convergence toward common long-run CMR values across countries. Updating the results from McArthur (2014) with the latest available data shows clear cross-country divergence in rates of progress for nearly four decades from the late-1950s through the late 1990s, meaning that countries with higher CMR were making systematically slower progress than countries with lower

CMR. (See Appendix 5 for results.) As of approximately the turn of the millennium, there is no longer a statistical difference in rates of progress across high- and low-mortality countries. In other words, there has at least been convergence in cross-country rates of progress, if not yet clear annual convergence toward common CMR values.

Taken together, these results indicate that the nature of global CMR progress post-2000 has been structurally different than during previous periods, especially for the poorest countries and those in Africa. Again, this does not on its own imply that the MDGs caused the change, but it does suggest a Type II (false negative) error in assertions that the MDG period was just a continuation of business as usual.

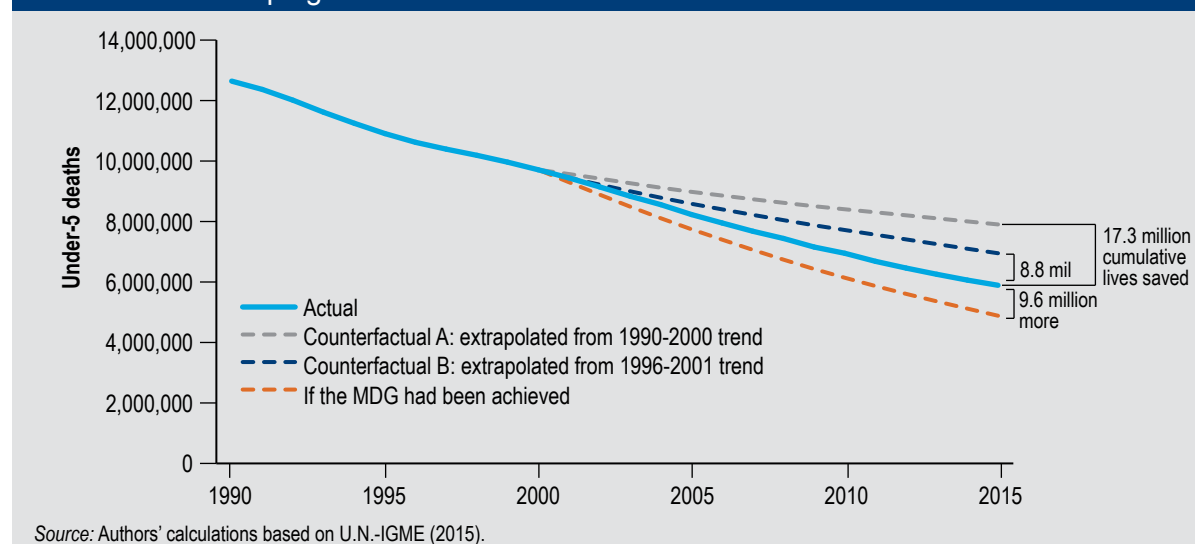
As a final layer of analysis, we consider the absolute human implications of changing CMR trends. Under Counterfactual A, we find that an incremental 17.3 million children survived to their fifth birthday during the period 2001-2015, compared with business as usual (BAU) trajectories as of 1990-2000. Under Counterfactual B, the corresponding figure is 8.8 million additional lives over 2002-2015. Figure 4.5 shows how the path of child deaths would have differed under Counterfactual A and

Table 4.1: Under-5 child mortality rate – difference in annual proportional rate of progress pre- and post-MDG (%)

	n	Counterfactual A			Counterfactual B		
		Mean rate 1990-2000	Mean rate 2000-2015	Difference of mean	Mean rate 1996-2001	Mean rate 2001-2015	Difference of mean
All developing countries	155	2.82 (2.36)	3.88 (1.88)	1.07*** [0.23]	3.46 (2.42)	3.88 (1.91)	0.42** [0.20]
Middle-income countries	90	3.40 (2.40)	3.56 (1.94)	0.16 [0.28]	3.68 (2.70)	3.54 (1.99)	-0.14 [0.28]
Low-income countries	65	2.01 (2.06)	4.34 (1.70)	2.33*** [0.31]	3.16 (1.97)	4.35 (1.70)	1.19*** [0.23]
East Asia & Pacific	24	2.69 (1.85)	3.23 (2.24)	0.54 [0.59]	3.04 (2.38)	3.20 (2.24)	0.17 [0.48]
Europe & Central Asia	28	3.53 (2.38)	5.16 (1.45)	1.63*** [0.52]	5.05 (1.73)	5.14 (1.51)	0.09 [0.40]
Latin America & Caribbean	31	3.75 (1.54)	2.87 (1.41)	-0.88*** [0.20]	3.76 (1.72)	2.81 (1.43)	-0.95*** [0.23]
Middle East & North Africa	15	4.37 (1.94)	3.95 (1.19)	-0.42 [0.54]	4.35 (1.85)	3.93 (1.21)	-0.43 [0.47]
South Asia	8	4.14 (1.77)	4.91 (2.58)	0.77* [0.37]	4.78 (2.47)	4.90 (2.54)	0.12 [0.19]
Sub-Saharan Africa	48	1.15 (2.33)	3.99 (1.74)	2.84*** [0.42]	2.08 (2.61)	4.05 (1.78)	1.97*** [0.42]

Notes: p-values: *<0.1, **<0.05, ***<0.01. Parentheses indicate standard deviation. Square brackets indicate standard error. Values are rounded and may not sum.

Figure 4.5: Total deaths in children under-5 compared to BAU trajectories, developing countries



Counterfactual B, compared with the actual reported trajectory. For completeness it also shows the trajectory if the MDG had been exactly achieved by all developing countries: An additional 9.6 million lives would have been saved. Thus even if there is cause for celebration in assessing the unprecedented shift in global CMR progress under the MDGs, there is ample cause for humility in light of a target not fully achieved.

Figure 4.6 shows the regional breakdown of gains under Counterfactual B. At one end of the spectrum, Latin America and the Caribbean had a negative net number of incremental lives saved, because of a regional slowdown from previously higher rates of progress. At the other end, Africa accounted for nearly 80 percent of the global gains, with more than 7 million incremental lives saved, even though only 12 of 48 African countries in the sample with data achieved the formal MDG target. The top contributors to the incremental global gains were Nigeria (1.03 million estimated lives), India (951,000), China (916,000), Ethiopia (692,000), and South Africa (633,000). These figures help to dispel any misunderstanding that most

of the global achievements of the past generation were simply driven by China and India.

1.a.i) Malaria

We consider malaria as a subcategory of CMR, since a considerable majority of malaria deaths occur among children under the age of 5.¹⁰ As of the early 2000s, malaria deaths accounted for approximately 12 percent of child deaths, and some of the most discernible MDG-linked policy efforts focused on malaria control (WHO 2016c). However, benchmarking malaria progress since 2000 is not straightforward, for three reasons. First, estimates of malaria-linked mortality are subject to measurement error and considerable debate in attributing cause of death. Second, pre-2000 country-level data on malaria deaths are spotty so it is difficult to discern counterfactual trends. Third, the challenge of malaria control is ultimately quite geographically focused, so the standard assessment of acceleration across all developing countries does not apply. As of 2000, there were 60 countries with an estimated 100 or more malaria deaths per year. Ninety percent of all deaths occurred in only 22 African countries

Figure 4.6: Children under-5: lives saved due to acceleration above 1996-2001 trajectory, by region

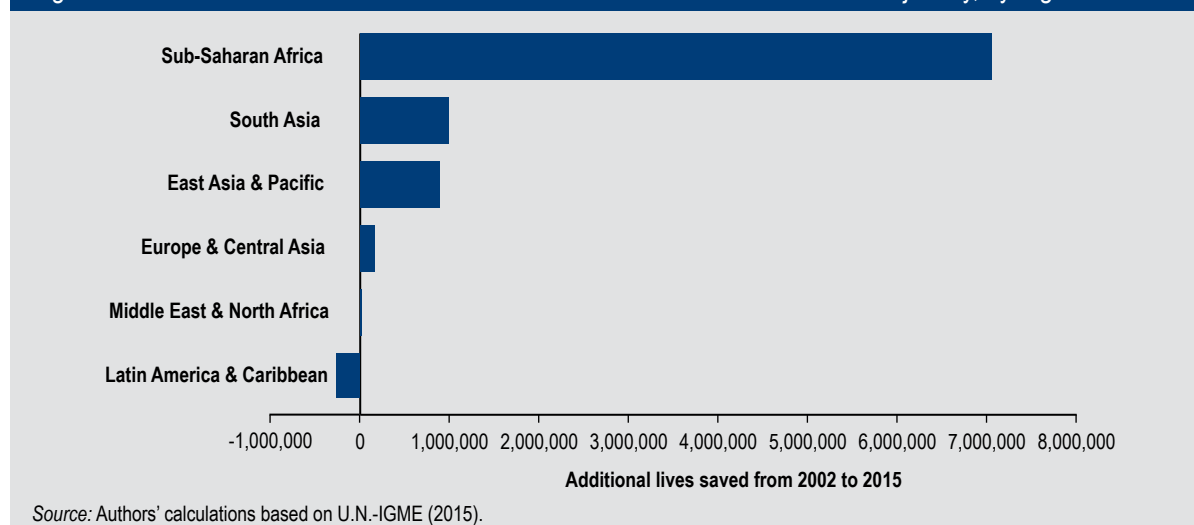


Table 4.2: Malaria deaths in 23 countries accounting for 90% of malaria deaths in 2000

Country	2000	2005	2013
Nigeria	210,000	190,000	120,000
DR Congo	100,000	110,000	50,000
Uganda	49,000	35,000	12,000
Mozambique	40,000	25,000	16,000
Burkina Faso	39,000	32,000	17,000
India	36,000	35,000	26,000
Cote d'Ivoire	33,000	32,000	16,000
Tanzania	30,000	20,000	17,000
Mali	27,000	23,000	20,000
Angola	22,000	22,000	14,000
Cameroon	20,000	21,000	9,400
Ghana	19,000	16,000	15,000
Malawi	16,000	9,700	7,800
Ethiopia	16,000	9,100	6,700
Guinea	15,000	12,000	11,000
Niger	15,000	14,000	12,000
Zambia	14,000	7,900	6,700
Kenya	13,000	10,000	9,900
Sierra Leone	12,000	12,000	7,800
Burundi	8,900	5,300	3,200
Benin	7,400	8,600	6,200
Togo	6,900	6,900	4,700
Liberia	6,700	4,100	2,200
Total - 23 countries	755,900	660,600	410,600
Total - 78 other countries	85,100	73,400	55,400
Developing world total	841,000	734,000	466,000

Source: Authors' calculations based on WHO (2016a).

plus India, with roughly a quarter occurring in Nigeria alone. These 23 countries are listed in Table 4.2.

In light of the measurement challenges, we identify 2005 as a pivotal year for MDG-linked malaria efforts. This was when the U.N. Millennium Project's recommendation for mass distribution of long-lasting insecticide-treated nets was presented and re-

ceived considerable public attention, and when the U.S. President's Malaria Initiative was subsequently launched on the eve of the Gleneagles G8 summit.¹¹

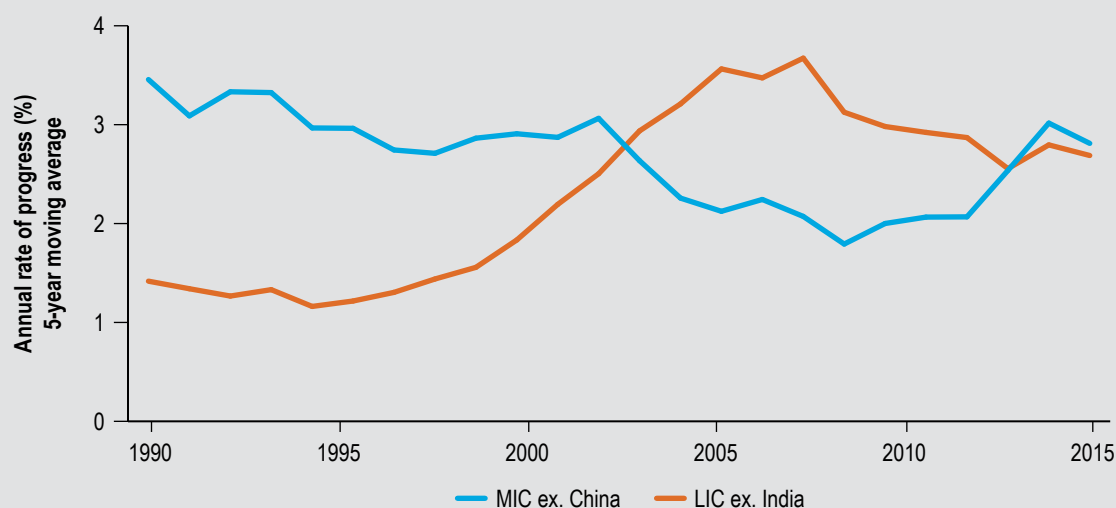
If we compare rates of progress from 2000-2005 with 2005-2013, there was a clear acceleration in gains: The annual rate of decline in the number of malaria deaths accelerated from dropping by an average of 2.7 percent per year to 5.6 percent per year. This was driven by acceleration in seven of the top 10 mortality countries. Three of those—Nigeria, the Democratic Republic of the Congo, and Uganda—were responsible for more than half the overall decline. Estimated malaria deaths are not reported annually, so it is not possible to estimate cumulative lives saved compared with pre-2005 counterfactuals. However, if trends from 2000 to 2005 had continued, there would have been approximately 180,000 additional deaths in 2013. A large share of these were likely children.¹²

1.b) Maternal mortality

Maternal mortality ratios (MMR) in developing countries fell by less than half overall between 1990 and 2015, well short of the MDG target of three-quarters reduction. Only 17 developing countries met the target, as the total number of maternal deaths decreased from approximately 528,000 per year in 1990 to 302,000 in 2015. Yet, as with child mortality rates, aggregate assessments mask important changes in underlying trends.

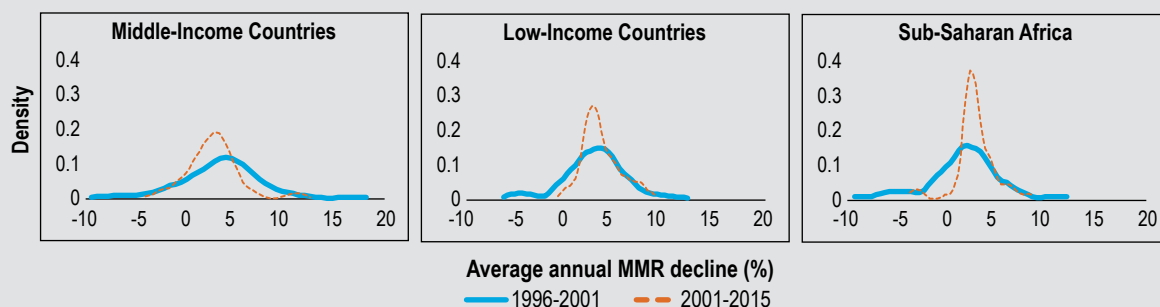
The first layer of analysis is to examine the year-to-year variation in proportional rates of progress. As with child mortality, maternal mortality had large accelerations starting in the late 1990s. But the key story is visible in Figure 4.7, which distinguishes between LICs and MICs, again excluding India and China. There is considerable year-to-year noise in the MMR data, so trends are smoothed here as five-year moving averages. The graph shows that LICs had steep acceler-

Figure 4.7: Annual change in maternal mortality ratio, LICs excluding India and MICs excluding China



Source: Authors' calculations based on World Bank (2016c).

Figure 4.8: Distribution of rates of progress on maternal mortality, 1996-2001 versus 2001-2015



Note: 82 middle-income countries; 65 low-income countries; 47 sub-Saharan African countries.

Source: Authors' calculations based on World Bank (2016c).

ations in the late 1990s and early 2000s while MICs actually decelerated for several years after 2000, before beginning to climb again. The acceleration in LICs is again important when considering how far behind those countries were at the start of the MDG period. In 2000, the birth-weighted average MMR in LICs was almost eight times that of the average in MICs.

Figure 4.8 presents pre- and post-MDG kernel densities for key country groupings, and Table 4.3 presents t-test results for difference in mean rates of progress. The average LIC increased its rate of progress by 1.3 percentage points between 1990-2000 and 2000-2015, significant at the 1 percent level, and by 0.6 percentage points between 1996-2001 and 2001-2015, although significant only at 10 percent levels. The average

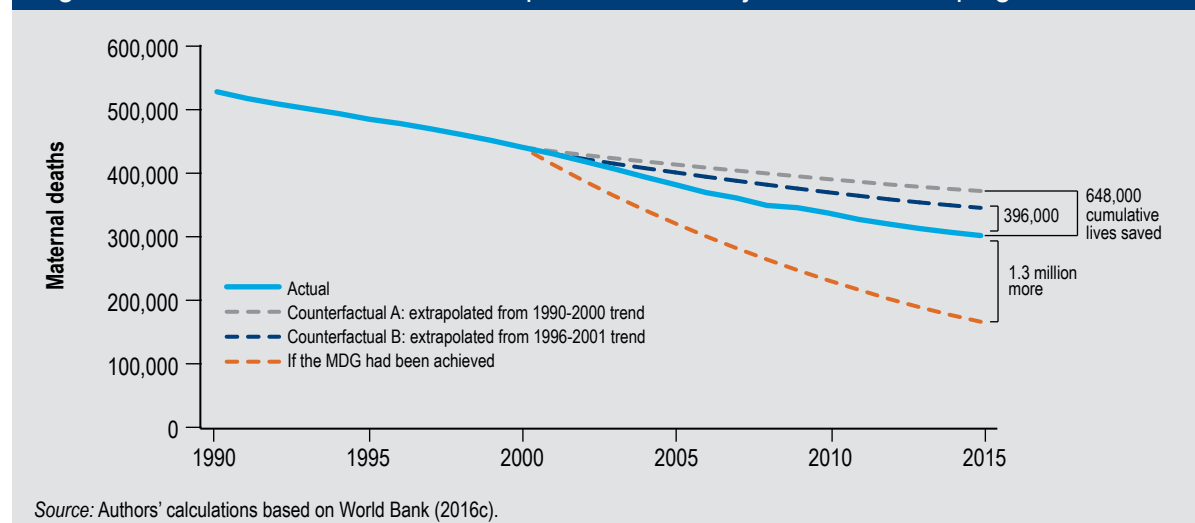
Table 4.3: Maternal mortality ratio - difference in annual proportional rate of progress pre- and post-MDG (%)

	n	Counterfactual A			Counterfactual B		
		Mean rate 1990-2000	Mean rate 2000-2015	Difference of mean	Mean rate 1996-2001	Mean rate 2001-2015	Difference of mean
All developing countries	147	2.70 (2.92)	3.07 (2.30)	0.37 [0.28]	3.20 (3.72)	3.06 (2.34)	-0.13 [0.31]
Middle-income countries	82	3.18 (3.26)	2.85 (2.55)	-0.33 [0.42]	3.52 (4.13)	2.80 (2.62)	-0.72 [0.48]
Low-income countries	65	2.10 (2.33)	3.35 (1.93)	1.25*** [0.29]	2.79 (3.11)	3.39 (1.92)	0.60* [0.33]
Europe & Central Asia	28	2.98 (2.60)	3.72 (3.16)	0.74 [0.74]	5.22 (3.56)	3.64 (3.26)	-1.58** [0.75]
Middle East & North Africa	15	4.56 (2.00)	2.86 (1.77)	-1.71*** [0.48]	3.97 (2.45)	2.82 (1.76)	-1.15* [0.58]
Sub-Saharan Africa	47	1.75 (2.42)	2.77 (1.82)	1.02** [0.43]	1.70 (3.42)	2.83 (1.90)	1.12** [0.50]

Notes: p-values: *<0.1, **<0.05, ***<0.01. Parentheses indicate standard deviation. Square brackets indicate standard error. Values are rounded and may not sum.

Source: Authors' calculations based on World Bank (2016c).

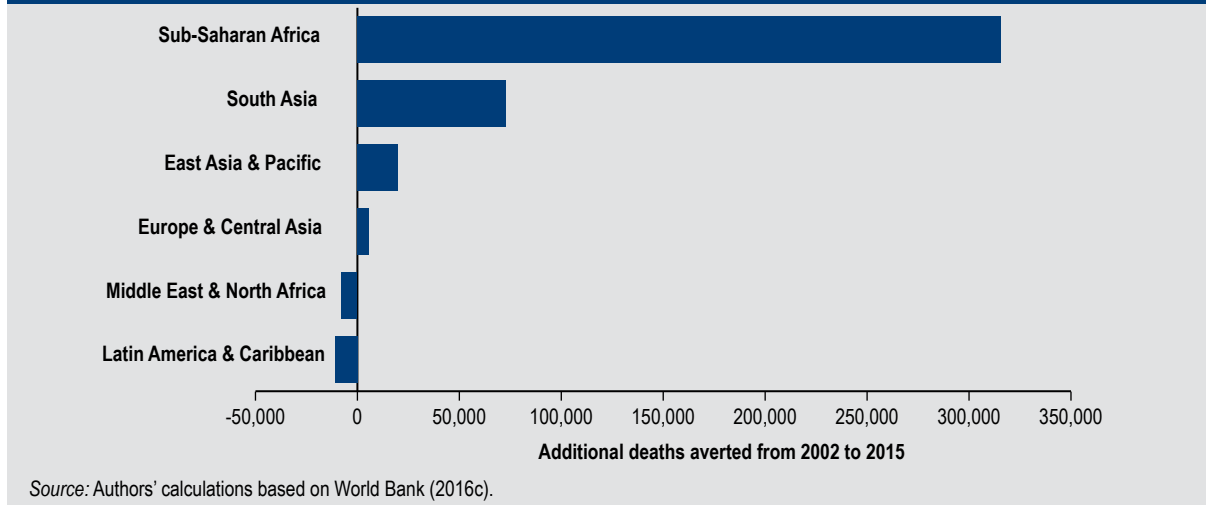
Figure 4.9: Total maternal deaths compared to BAU trajectories, developing countries



African country accelerated by more than 1 percentage point per year compared with both pre-MDG reference periods. In contrast, the average country in Europe and Central Asia experienced a slowdown in progress between 1996-2001 and 2001-2015, significant at the

5 percent level. The Middle East and North Africa also showed evidence of slow-down during the 2000s, but there were no statistically significant changes in rates in other regions (see Appendix 4 for all regions' results). Overall, accelerations were again concentrated in areas

Figure 4.10: Mothers' lives saved due to acceleration above 1996-2001 trajectory, by region



that started furthest behind. At the individual country level, 35 of 65 LICs accelerated at least 1 percentage point between 1990-2000 and 2000-2015, including 24 LICs in Africa. Only 31 of 82 MICs had any acceleration.

Translating maternal mortality ratios into number of deaths averted shows the implications of post-2000 accelerations. Figure 4.9 shows the actual, counterfactual, and MDG trajectories. Compared with Counterfactual A based on the full 1990s trends, approximately 648,000 additional maternal deaths would have occurred between 2001 and 2015 had BAU persisted.¹³ The corresponding figure is 396,000 deaths under Counterfactual B. Figure 4.10 shows that most of the accelerations again occurred in Africa. Nonetheless, if all 147 countries had met the goal exactly for maternal mortality rates, 1.3 million more deaths would have been averted, with close to 1 million of those in Africa alone.

1.c) HIV/AIDS

HIV/AIDS presented one of the world's most distressingly unaddressed life and death challenges at the time the MDGs were launched. Progress on this issue since

then is tricky to benchmark. First, the original MDG language for HIV/AIDS lacked quantitative specificity. For reasons discussed earlier, we interpret the goal with a focus on total AIDS-related deaths. Second, we are unable to measure acceleration in reduction of deaths between pre- and post-MDG periods because of limited data availability before 2000. Third, the majority of countries with large epidemics peaked in the mid-2000s, which makes a simple acceleration calculation unhelpful, since many countries were not heading in a positive direction to begin with.

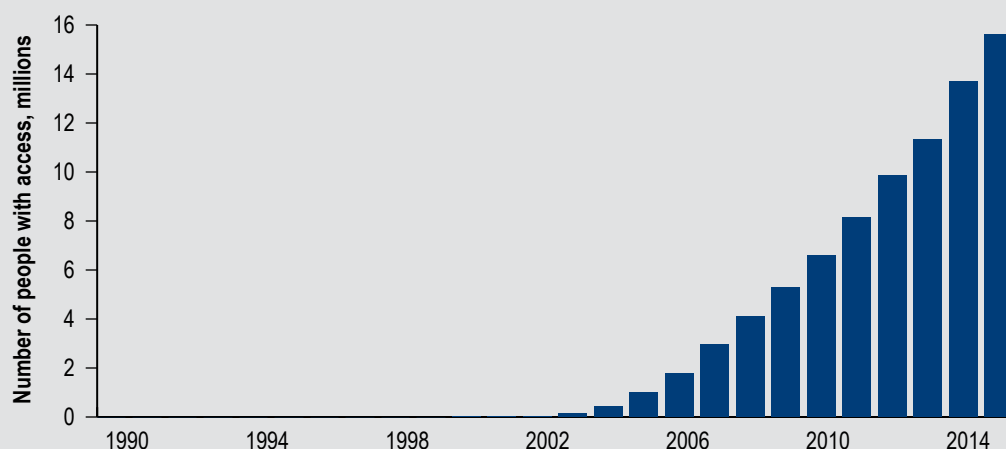
In that context, assessing global progress on HIV/AIDS during the 2000s requires some analytical care, because it was a classic case of "learning by doing" in applied health research and relevant protocols. The original MDG target was extracted from the 2000 Millennium Declaration, prior to the advent of international treatment efforts, with an ambition to "have halted by 2015 and begun to reverse the spread of HIV/AIDS." This implied an initial focus on reducing HIV prevalence.

Things then changed after international AIDS treatment programs were launched during the early 2000s. Early scale-up successes supported by the Global Fund to Fight AIDS, TB and Malaria and the U.S. bilateral support program (PEPFAR) prompted heightened global ambition. At the 2005 U.N. World Summit, a target was set to achieve universal access to treatment by 2010. This became MDG target 6.B, although “universal access” was still estimated to mean only around 6 million people. That figure was based on medical protocols suggesting that only those patients with the most suppressed immune systems, measured by CD4 blood counts, should receive antiretroviral therapy. However, as evidence became available to support the need for earlier treatment, the definition of universal access expanded. In 2011, a new U.N. target was thereby established to provide treatment for 15 million people by 2015 (UNAIDS 2014). Then, in 2015, the CD4 threshold was updated once more to recommend treatment for all HIV-infected people. This led to the current estimate of approximately 35 million individuals requiring antiretroviral therapy across all developing countries.

Expanded access to antiretroviral treatment was a crucial factor in reducing deaths from HIV/AIDS. As of 2000, only seven developing countries—Argentina, Brazil, Chile, Costa Rica, Mexico, Panama, Uruguay—are reported to have had more than 5 percent of HIV-infected people with access to treatment (World Bank, 2016c). Scale-up expanded particularly dramatically over the decade from 2005 to 2015, with the number of people accessing treatment across developing countries increasing more than ten-fold to reach well over 15 million people, as shown in Figure 4.11. Overall, the Joint United Nations Programme on HIV/AIDS (UNAIDS) estimates that 8.9 million HIV-related deaths were averted due to access to treatment between 2000 and 2015 (UNAIDS 2016b).¹⁴

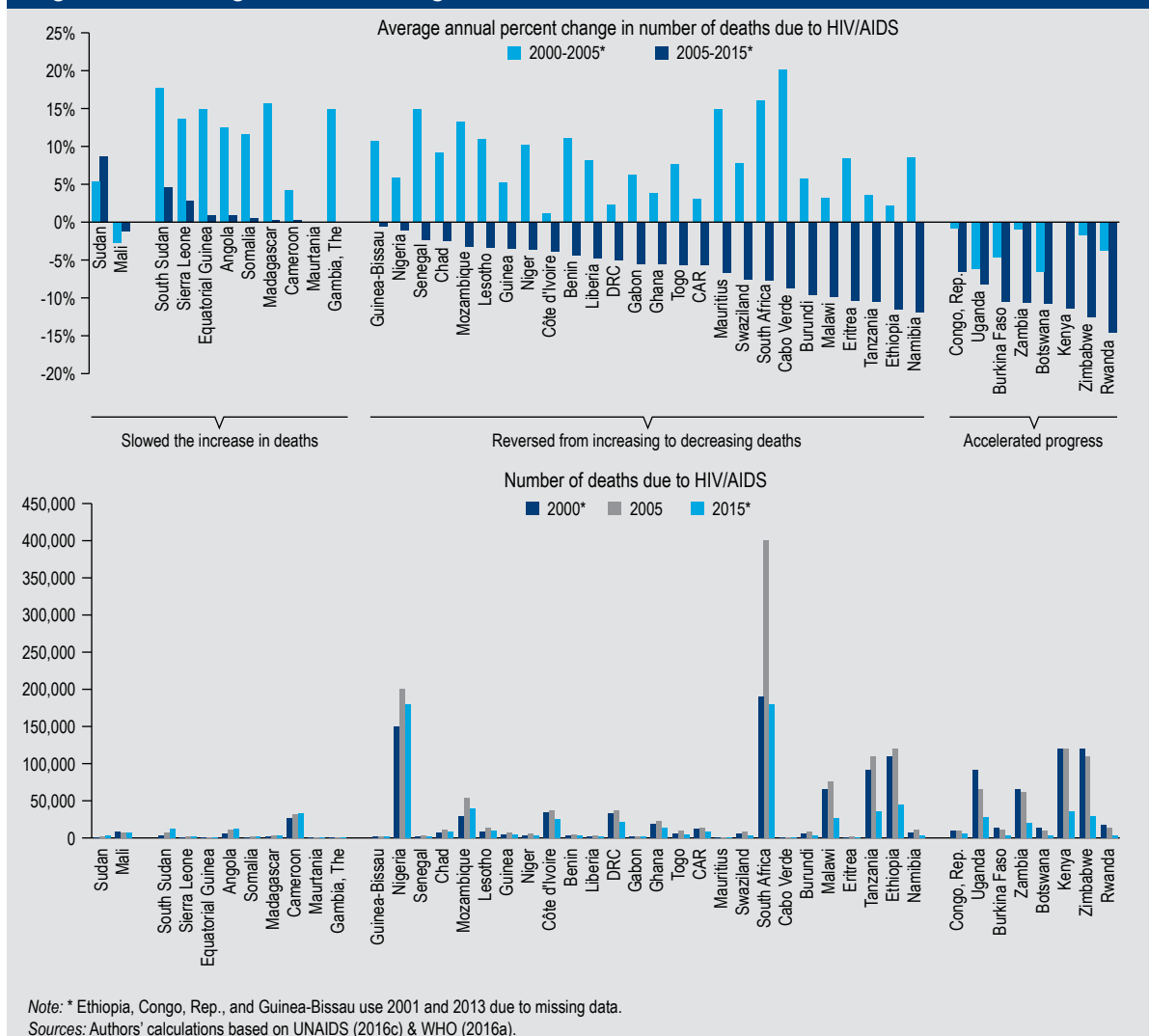
Looking at regional trends, Africa’s AIDS-related deaths are estimated to have peaked in 2005 at 1.6 million, and then fell 50 percent to 800,000 by 2015 (UNAIDS 2016c). The gains were greatest in geographies that had furthest to go at the outset. Figure 4.12 shows that, among the 45 African countries with data,

Figure 4.11: Expansion of access to antiretroviral treatment in developing countries, 1990–2015



Source: Authors' calculations based on UNAIDS (2016c) and World Bank (2016c).

Figure 4.12: Progress in reducing deaths due to HIV/AIDS in sub-Saharan Africa



34 either flipped from increasing to decreasing year-on-year deaths between 2000-2005 and 2005-2015, or else further accelerated their rate of progress in reducing deaths. For the nine countries in the “slowed the increase” category, their HIV/AIDS deaths as of 2015 have either stabilized or are still increasing yet at a slower rate. The case of South Africa has been particularly important. It had the highest number of deaths from the virus, peaking at 410,000 in 2006 and 2007, and then the number declined by an average of 9.8

percent annually until 2015, when deaths were down to 180,000.

1.d) Tuberculosis deaths

Tuberculosis is often a source of comorbidity and mortality alongside HIV/AIDS, but the World Health Organization (WHO) reports non-HIV-related TB deaths, which allows us to assess the two diseases separately. Attributing cause of death is an inherently tricky challenge, especially in low-income environments, so

we present the relevant data with that caveat emphasized. Officially, the U.N. declared that the burden of TB decreased under the MDG period and the relevant target was successfully achieved (U.N. MDG Report 2015). However, the WHO's recent TB report highlights the challenge of TB measurement, and in particular the relatively poor data quality before 2000 (WHO 2016b). The same WHO report provides estimates of TB deaths only from 2000 onward, so we do not conduct pre- versus post-2000 acceleration tests on this indicator.

The annual number of estimated deaths from TB fell from almost 1.7 million in 2000 to 1.4 million in 2015. Figure 4.13 shows the regional composition of deaths over the period. All regions except Africa experienced an estimated reduction in deaths from the disease. For its part Africa had a small aggregate increase, driven mainly by Nigeria and the Democratic Republic of the Congo. The figure highlights how declines have largely been driven by gains in Asia, especially China, Myanmar, and India. India is notable because it has accounted for roughly a third of the developing world's

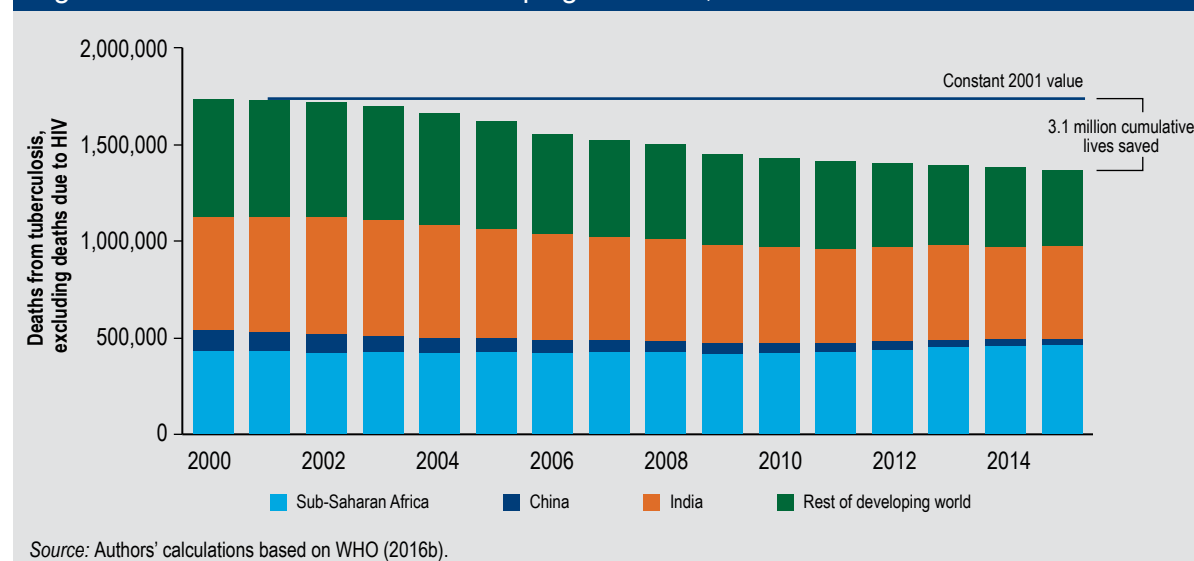
TB deaths each year since 2000. The country's deaths to the disease are estimated to have fallen from a peak of 610,000 in 2002 to 480,000 in 2015.

Because of the problems with pre-2000 data quality and the high level of uncertainty in year-to-year country observations, we calculate only one TB counterfactual, based on a trajectory of each country's annual number of deaths to the disease remaining constant from 2001 onward. This is a conservative assumption because many countries' death levels were estimated to be climbing during the late 1990s and early 2000s (WHO 2015).¹⁵ Under this counterfactual, approximately 3.1 million lives were saved cumulatively from 2002 to 2015. Roughly 1.6 million of these occurred in developing countries outside of China and India.

1.e) Total lives saved due to acceleration since 2000

To establish a plausible range of cumulative overall lives saved during the MDG period, we sum the number of incremental child, maternal, TB-infected, and

Figure 4.13: Total TB deaths in developing countries, 2000-2015



HIV-infected lives saved, compared to pre-MDG trajectories. Summary results are presented in Table 4.4. (Full regional results are available in Appendix 4.) Note that there is limited overlap between the categories, with the exception of HIV/AIDS, for which less than 3 percent of HIV/AIDS deaths as of 2002 were estimated to be among children under 5 (based on WHO 2016a). We scale down the HIV/AIDS figures accordingly within the table.

The first column of Table 4.4 shows the estimated range of incremental lives saved across all developing countries from 2000/2001 to 2015. By summing up across categories, and recognizing the different counterfactual scenarios considered for each, we estimate a total of 21.0 million to 29.7 million incremental lives saved.

The middle columns of Table 4.4 present estimates for special geographies of interest: China, India, sub-Saharan Africa, and the rest of the developing world as a whole. The majority of the lives saved were in Africa,

arguably the area with the greatest challenges to MDG achievement at the outset. Approximately 14.1 million to 19.9 million additional people are alive who would not have been had the region continued on its pre-MDG trajectory. Improvements in child survival and AIDS survival were the foremost drivers of improved overall outcomes. The set of columns on the right then presents values by initial income group as of 2000. In LICs outside of India, an estimated 12.8 million to 19.5 million additional lives were saved above business-as-usual trajectories. The comparable number for MICs outside of China is around 4.1 million people.

2. Basic needs

MDG indicators for basic needs are measured as percentages of entire populations, so even small changes translate to a large number of lives affected. The 154 developing countries in our sample had a total population of 6.3 billion in 2015, hence every percentage point aggregate change translates to 63 million lives

Table 4.4: Millions of lives saved between 2000/2001 and 2015 due to accelerated progress

	Aggregate	Geography				Income group	
	All developing	China	India	Sub-Saharan Africa	Rest of developing world	Low-income ex. India	Middle-income ex. China
Child mortality	8.8 to 17.3	0.9 to 1.9	1.0 to 1.9	7.0 to 12.6	(0.1) to 0.8	6.4 to 12.9	0.6
Maternal mortality	0.4 to 0.6	(0.003) to 0.007	0.03 to 1.0	0.3 to 0.5	0.04 to 0.05	0.3 to 0.5	(0.01) to 0.007
Tuberculosis deaths	3.1	0.6	1.0	0.004	1.6	1.2	0.4
HIV/AIDS deaths	8.7	0.2	0.5	6.8	1.2	4.8	3.1
TOTAL	21.0 to 29.7	1.7 to 2.7	2.5 to 3.5	14.1 to 19.9	2.7 to 3.7	12.8 to 19.5	4.1

Notes: Calculations based on extrapolations of pre-MDG trends compared to actual values from 2001 to 2015. Parentheses denote negative (fewer) lives saved compared to trend. Child and maternal mortality ranges based on Counterfactual A (trend extrapolated from 1990 to 2000) and Counterfactual B (extrapolated from 1996 to 2001). Values for TB assume deaths in each country remained constant from 2001 onward. HIV/AIDS based on estimated deaths averted due to antiretroviral therapy (ART), with disaggregation weighted by distribution of people with access to ART.

Sources: Authors' calculations based on UN-IGME (2015), World Bank (2016c), WHO (2016b), UNAIDS (2016b, c).

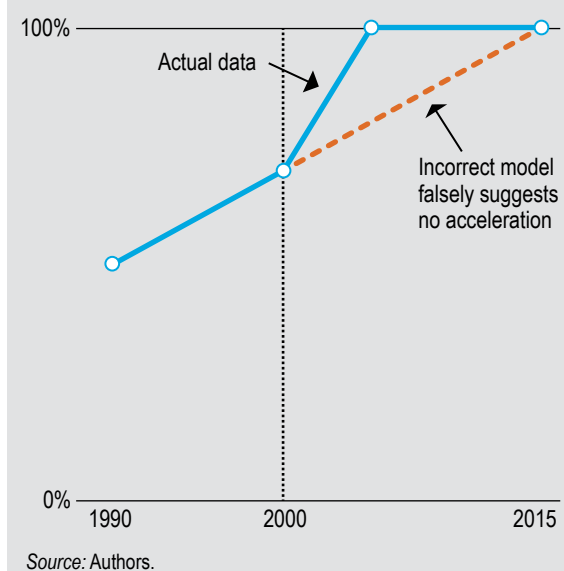
improved. As mentioned in the methodology section, we focus on absolute (percentage point) annual rates of change for this category of outcomes. This aligns with methods of earlier studies and is consistent with the analytical notion, contrary to mortality measures, of expanding access to a relatively constant set of basic technologies, such as staple foods or drinking water.

We adjust the basic needs calculations to align with the nature of the data. Because basic needs ultimately focus on achieving full population coverage as a core standard, we modify the rate of progress calculations to account for the data's natural ceiling—for example, 100 percent access to drinking water—before 2015. For countries that hit the relevant ceiling between 2000 and 2015, we calculate the average rate of progress up to the year when the ceiling was hit, rather than all the way to 2015. As illustrated in Figure 4.14, failing to account for such data boundaries (censoring) could lead to misinterpretation of post-MDG rates of progress. We also adjust the acceleration tests to exclude countries that had already reached within 1 percentage point of the ceiling by 2000, because we do not consider it useful to try to discern patterns of acceleration within such a narrow margin.

2.a) Water and sanitation

The U.N. celebrated improved access to drinking water as an early MDG success. In developing countries, access grew from around 70 percent of the population in 1990 to 89 percent by 2015, easily exceeding the goal to cut the share without access by half (U.N. MDG Report 2015). The sanitation target was deemed less successful, with access expanding from 43 percent of the population in 1990 to 62 percent by 2015. But a more careful analysis shows that overall rates of progress in both water and sanitation remained steady over the period, as indicated in Figure 4.15. The population-weighted average rate of progress was consis-

Figure 4.14: Adjusting rates of progress for data censoring



tently around 0.7 percentage points per year for both water and sanitation.¹⁶

Unpacking the numbers by geography again sheds light on some important trends. T-test results in Table 4.5 show that LICs accelerated average progress by approximately 0.1 percentage points per year on both water and on sanitation. The difference is quantitatively modest but statistically significant: A 0.1 percentage point average acceleration adds up to a 1.5 percentage point difference from BAU trajectories after 15 years. Interestingly, MICs registered small average slowdowns in access to water and access to sanitation, both significant at 1 percent levels.

At the regional level, African countries experienced a small average acceleration on sanitation but no clear difference on water. Latin America and Caribbean countries experienced a small but statistically significant average slowdown for both water and sanitation, while in Europe and Central Asia the average rate of progress

Figure 4.15: Annual percentage point change in access to water and sanitation, developing countries

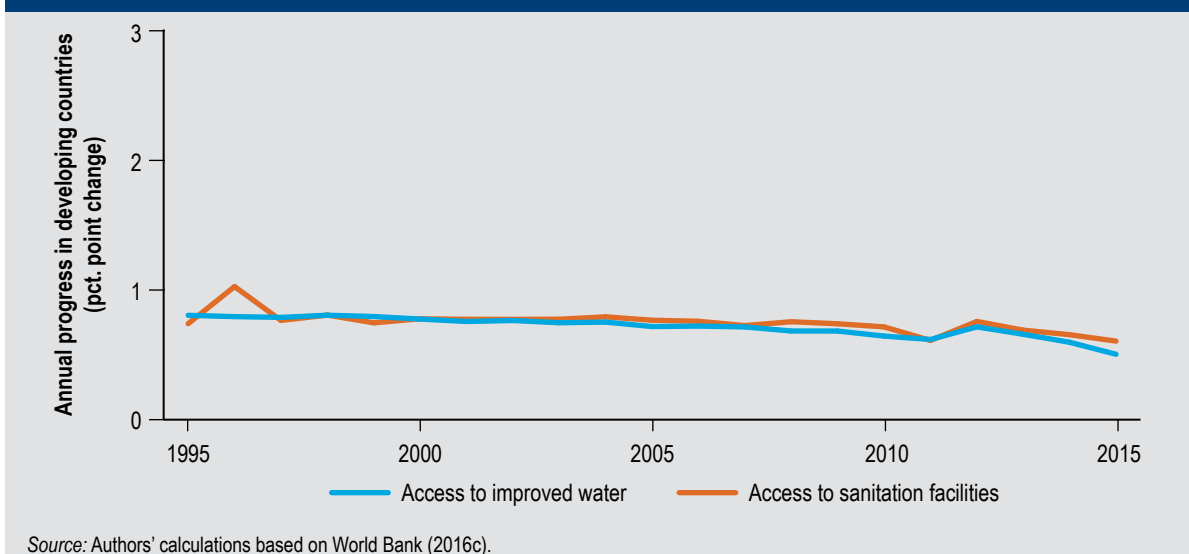


Table 4.5: Water and sanitation—differences in annual absolute rate of progress pre- and post-2000 (percentage points)[†]

	n	Access to water			n	Access to sanitation		
		Mean rate pre-2000	Mean rate post-2000	Difference of mean		Mean rate pre-2000	Mean rate post-2000	Difference of mean
All developing countries	138	0.53 (0.52)	0.55 (0.53)	0.02 [0.02]	139	0.51 (0.55)	0.53 (0.57)	0.01 [0.02]
Middle-income countries	77	0.42 (0.41)	0.37 (0.37)	-0.05*** [0.02]	77	0.55 (0.59)	0.47 (0.52)	-0.08*** [0.02]
Low-income countries	61	0.68 (0.59)	0.78 (0.61)	0.10*** [0.04]	62	0.48 (0.50)	0.61 (0.61)	0.13*** [0.04]
Sub-Saharan Africa	45	0.70 (0.59)	0.74 (0.57)	0.04 [0.03]	46	0.32 (0.36)	0.40 (0.43)	0.08** [0.03]

Notes: p-values: * <0.1 , ** <0.05 , *** <0.01 . Parentheses indicate standard deviation. Square brackets indicate standard error. Values are rounded and may not sum. [†]Sample years adjusted to account for data availability where needed.

Source: Authors' calculations based on World Bank (2016c).

for water increased by 0.1 percentage points per year (see Appendix 4 for full regional tests). Other regions had no clear shifts in trends. Interestingly, China and India account for a large part of the global story for water and sanitation, unlike for life and death issues. Both countries achieved considerable overall gains, but with slowdowns in their rates of progress after 2000.

The consistent rates of progress on water and sanitation generate modest results for our estimates of incremental lives improved, compared with BAU, as shown in Table 4.6. Negative numbers are denoted with parentheses. Note that the elements of lives improved in Table 4.6 should not be added across indicators, because of likely overlap among populations. For wa-

Table 4.6: Water and sanitation: Millions of lives improved as of 2015 - or not - due to accelerated progress since 2000

	Aggregate	Geography				Income group	
	All developing	China	India	Sub-Saharan Africa	Rest of developing world	Low-income ex. India	Middle-income ex. China
Access to water	(99)	(62)	(22)	3	(18)	(2)	(13)
Access to sanitation	19	10	10	17	(19)	25	(27)

Notes: Calculations based on extrapolations of pre-MDG trends compared to actual values in 2015, or most recent available year. Parentheses denote negative (fewer) lives improved compared to trend. Totals based on country-level trend extrapolation from approximately 1990 to 2000 / 2001.

Source: Authors' calculations based on World Bank (2016c).

ter, approximately 99 million *fewer* lives were improved than if trajectories from 1990-2000 had continued, with China and India responsible for much of that figure. Meanwhile Africa achieved a net positive net increment of 2.6 million people with access, but this is not materially different from zero when compared with the region's population of approximately 1 billion in 2015.

Slightly more lives are estimated to have been improved by accelerated gains on sanitation. Overall nearly 19 million more people were estimated to have access compared with BAU trends, including modest positive increments in China, India, and Africa. As a group, LICs excluding India achieved a net positive increment of 25 million people, equivalent to roughly 1.3 percent of the relevant population, while MICs excluding China had a net negative increment of 27 million, equivalent to around 1.6 percent of that group's population.

2.b) Undernourishment

Developing countries overall came close to halving hunger between 1991 and 2015. FAO data suggest undernourishment dropped overall from 24 percent of the population in 1991 to 13 percent by 2015. As

mentioned in the methods section, time-series data on undernourishment are available for only 111 developing countries (55 LICs and 56 MICs), so the following country-level results are limited to this sample. The lowest undernourishment value reported by the FAO for any country is 5 percent, so we exclude countries from acceleration tests if they had less than 6 percent undernourishment as of 2000, similar to the adjustment described earlier for access to water and sanitation. We also adjust post-MDG rate of change calculations to account for countries that reached 5 percent undernourishment prior to 2015.

The kernel densities in Figure 4.16 show that MICs, LICs, and African countries all showed positive shifts in the average country rate of progress post-2000. The t-tests in Table 4.7 show that LICs experienced the largest gains, with their average rate of progress increasing from 0.37 percentage points per year to 0.79 after 2000, the difference being statistically significant at 5 percent levels. African countries had a similar average acceleration from 0.27 percentage points per year to 0.64 after 2000. This translates to an implied difference from BAU trends of 5.6 percentage points after 15 years. MICs also had a statistically significant acceleration from an average 0.24 to 0.55 percentage points per year.

Figure 4.16: Distribution of annual rates of progress in undernourishment, 1991-2000 versus 2000-2015

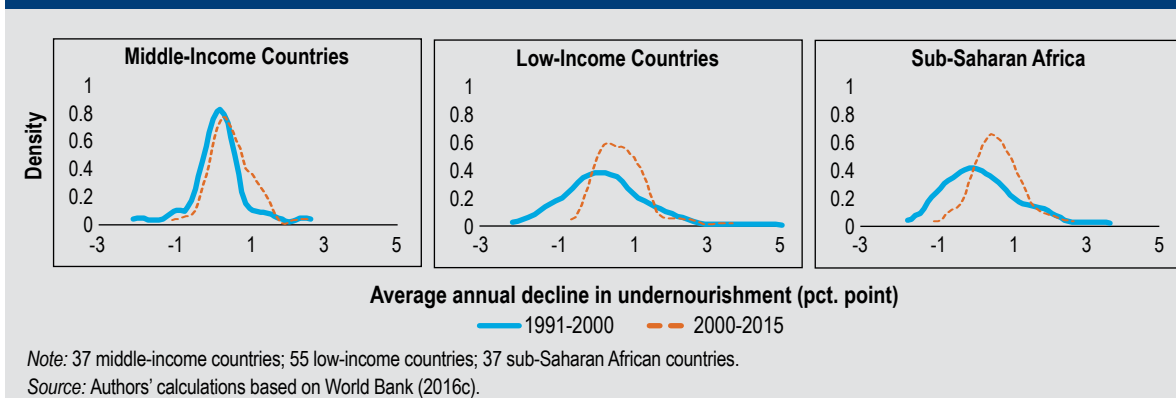


Table 4.7: Undernourishment and primary school completion—differences in annual absolute rate of progress pre- and post-2000 (percentage points)

	n	Undernourishment			n	Primary school completion rate [†]		
		Mean rate 1991-2000	Mean rate 2000-2015	Difference of mean		Mean rate pre-2000	Mean rate post-2000	Difference of mean
All developing countries	92	0.32 (1.02)	0.69 (0.67)	0.37*** [0.11]	78	0.62 (1.49)	1.31 (1.12)	0.69*** [0.22]
Middle-income countries	37	0.24 (0.75)	0.55 (0.58)	0.30** [0.13]	38	0.70 (1.24)	0.86 (0.99)	0.17 [0.26]
Low-income countries	55	0.37 (1.17)	0.79 (0.71)	0.41** [0.17]	40	0.54 (1.70)	1.73 (1.09)	1.19*** [0.33]
Sub-Saharan Africa	37	0.27 (1.02)	0.64 (0.65)	0.37** [0.17]	30	0.34 (1.63)	1.60 (0.96)	1.27*** [0.42]

Notes: p-values: * <0.1 , ** <0.05 , *** <0.01 . Parentheses indicate standard deviation. Square brackets indicate standard error. Values are rounded and may not sum. [†]Sample years adjusted to account for data availability where needed.

Source: Authors' calculations based on World Bank (2016c).

The overall implication of these undernourishment trends is somewhat nuanced. Although many developing countries experienced post-2000 acceleration in reducing undernourishment, 30 countries, including China and India and several other populous countries, experienced deceleration. Seven countries—Central African Republic, Guyana, Jamaica, Namibia, North Korea, Swaziland, and Zambia—even experienced a reported increase in undernourishment rates post-2000.

As shown in Table 4.8, approximately 100 million to 169 million additional people are undernourished compared with what would have been the case if constant annual progress had continued. Data limitations mean that we are not able to present estimates for LICs and MICs on this measure. But if China had remained on its 1990s trajectory, an additional 4 million to 59 million fewer people would be undernourished as of 2015. If India had continued on its 1990s trajectory, an additional 80 million to 123 million people would be undernourished

Table 4.8: Hunger and primary education: Millions of lives improved as of 2015 - or not - due to accelerated progress since 2000

	Aggregate	Geography			
	All developing	China	India	Sub-Saharan Africa	Rest of developing world
Undernourishment	(169) to (100)	(59) to (4)	(123) to (80)	(16) to 3	0 to 10
Primary school completed	59 to 111	N/A	N/A	15 to 25	N/A

Notes: Calculations based on extrapolations of pre-MDG trends compared to actual values. Parentheses denote negative (fewer) lives improved compared to trends. For undernourishment, values indicated as of 2015. For primary completion, values are cumulative from 2001 to 2013. Ranges based on Counterfactual A (trends extrapolated from 1990/91 to 2000) and Counterfactual B (extrapolated from 1996 to 2001) using World Bank regional and developing country aggregates, as classified in 2016. See Appendix 2 for details.

Sources: Authors' calculations based on World Bank (2016c) U.N.-DESA (2015).

in 2015. When these two countries are excluded from the calculation, the net number of incremental lives improved ranges from negative 16 million to positive 13 million—in other words, indistinguishable from zero.

Note that these non-positive estimates of incremental lives improved should not be interpreted as downplaying the extent of absolute gains since 2000. They imply only that hunger's aggregate decline followed BAU trajectories, even if rates of progress accelerated in many individual countries.

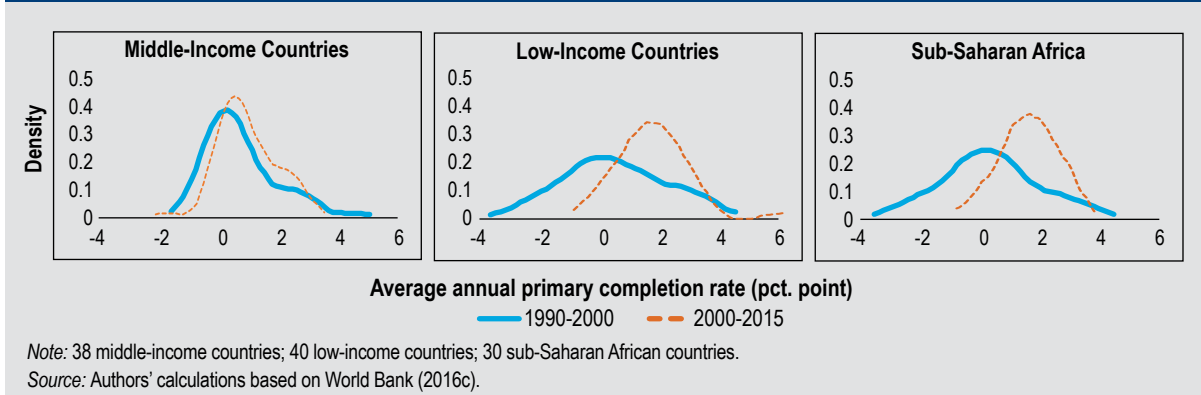
2.c) Primary school completion

The developing world fell short on the MDG to achieve universal primary school completion by 2015. However, it did register significant accelerations in progress by multiple measures. Across all countries with data, the average annual rate of progress more than doubled, accelerating from 0.62 to 1.35 percentage points per year, as shown in Table 4.7. Note that we again exclude countries from acceleration tests if they already achieved at least a 99 percent primary completion rate as of 2000; we also adjust rate of progress calculations to account for countries reaching 100 percent completion before 2015.

As with other indicators, rates of progress in MICs had little acceleration from their typically higher starting primary completion values, while LICs and Africa experienced major acceleration. Twenty-nine out of 40 LICs experienced “real” acceleration of at least 0.33 percentage points per year in their rate of progress. The kernel density in Figure 4.17 suggests a modest rightward shift in the distribution for MICs. In Africa, the average country rate of progress in the 2000s was almost five times what it was during the 1990s. It accelerated from 0.34 percentage points per year to 1.60 after 2000. LICs' post-MDG rate of progress is more than three times as fast as pre-MDG rates. At the regional level, East Asia and the Pacific also had a statistically significant increase in its rate of progress by 1.2 percentage points (see Appendix 4 for all regions' results).

As indicated in Table 4.8, the acceleration in rates of progress led to an estimated 59 million to 111 million more people completing primary school between 2000 and 2013 (the most recent year with available data) than would have under pre-MDG trajectories. In Africa, this corresponding outcome is between 15 million and 25 million additional people, roughly a quarter of the global total. Of course, the extent to which primary school completion rates affected learning outcomes is an

Figure 4.17: Distribution of annual rates of progress in primary school completion, 1990-2000 versus 2000-2015



important separate question that lies beyond the scope of this paper.

2.d) Gender equality

To benchmark the gender equality target, we use the gender parity index (GPI) for gross enrollment, recognizing it is a very narrow metric for much more complex underlying gender issues. In line with the U.N. norms, we count any female-to-male enrollment index score greater than 0.97 as “success,” acknowledging the tremendous simplification embedded in this approach. The U.N. reports that developing countries as a group reached the target to eliminate gender disparity in primary, secondary, and tertiary education by 2015 (U.N. MDG Report 2015). But success was mostly concentrated among countries that were already on track in 2000.

To examine acceleration, we consider 53 countries with available data that had a primary enrollment GPI value of less than 0.96 as of 2000, i.e., 1 percentage point short of the 0.97 standard.¹⁷ Thirty-five of these countries showed post-2000 acceleration, including 20 out of 37 LICs registering “real” acceleration. T-tests indicate that the average rate of primary GPI progress

among the 53 countries increased by a statistically significant 0.62 percentage points per year (see full results in Appendix 4). Meanwhile, at the secondary level, only 18 out of 35 relevant countries with data started at GPI below 0.96 in 2000 and experienced acceleration.¹⁸ At the tertiary level, only 35 countries with adequate data began the period below the 0.96 threshold and 23 of them accelerated.

Figure 4.18 compares percentage point gains in primary GPI, on the horizontal axis, against post-2000 acceleration in progress, on the vertical axis. The graph shows, above the dashed horizontal line, the large number of countries that experienced acceleration while achieving a wide range of overall progress. For example, Swaziland on the far left side of the graph had an overall decline in GPI between 2000 and 2015, while countries like Ethiopia and Guinea-Bissau on the far right had gains of more than 25 percentage points. Of course, countries can achieve high GPI values while still at low levels of schooling for both genders, so Appendix 6 includes a scatterplot of GPI against primary school completion rates as additional context. Because of data gaps we do not attempt to estimate the number of girls’ lives improved due to GPI improvements.

3. The special case of extreme income poverty

The World Bank and U.N. report that the developing world achieved the MDG target of halving the proportion of people living in extreme income poverty in advance of the 2015 deadline (World Bank 2016a). There are vigorous professional debates regarding the precise measurement of extreme poverty, but the numbers are broadly understood to have experienced a major decline over the past 25 years (World Bank 2016d).

As mentioned earlier, only 36 countries have adequate poverty trend data to compare pre- and post-MDG rates of progress. Among countries with sufficient data, 23 experienced acceleration after 2000. Fifteen of those

countries quickened their rate of progress by at least 0.33 percentage points annually. The small sample means that t-tests for country-level changes need to be interpreted with caution. As reported in Appendix 4, 25 MICs recorded average acceleration of 0.62 percentage points per year, significant at 5 percent levels, while 11 LICs recorded even greater average acceleration, but this was not statistically significant.

To construct global and regional aggregate poverty trends, we use the World Bank's PovcalNet data. In doing so, there is no question that China and India have been responsible for a large share of the change in extreme poverty head-count ratios. However, even when these countries are excluded from the calculation, preliminary World Bank data suggest that extreme

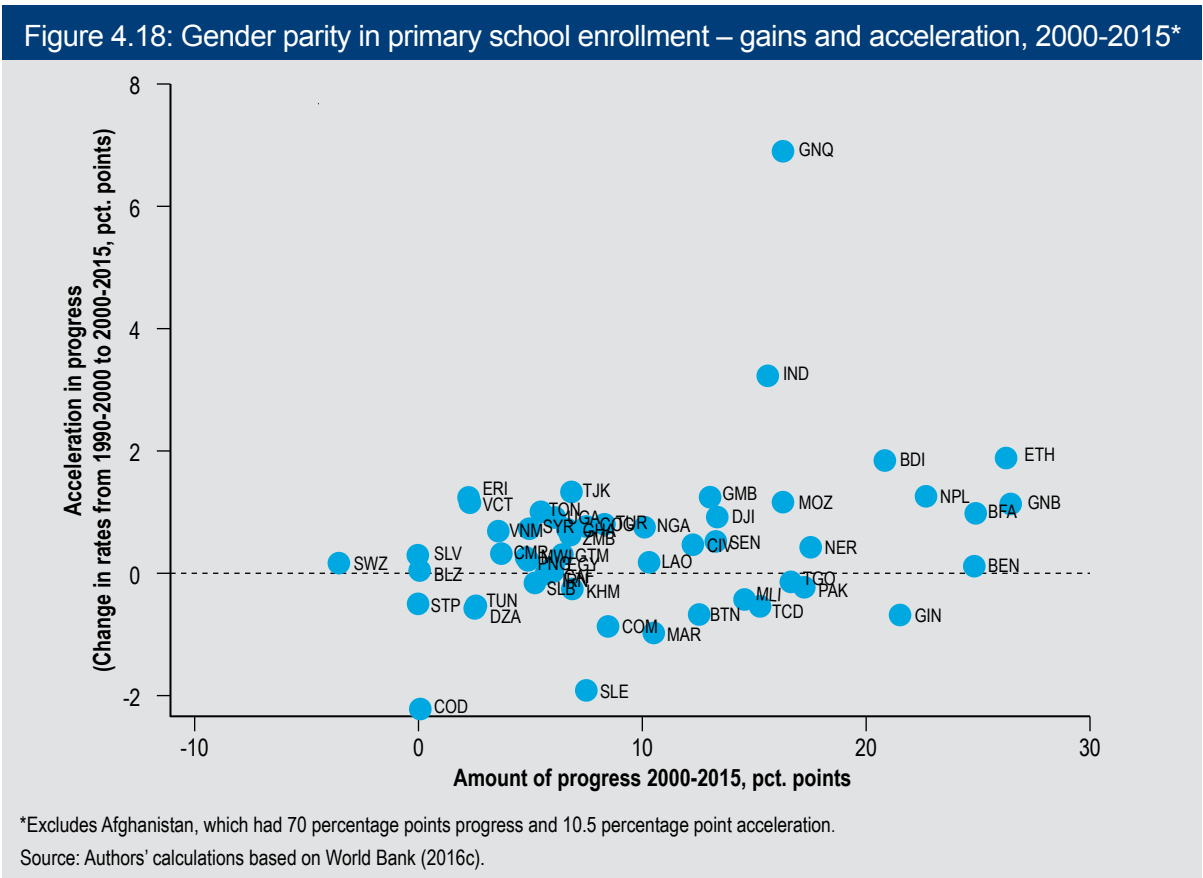


Figure 4.19: Shifting trajectories in extreme income poverty since 2002

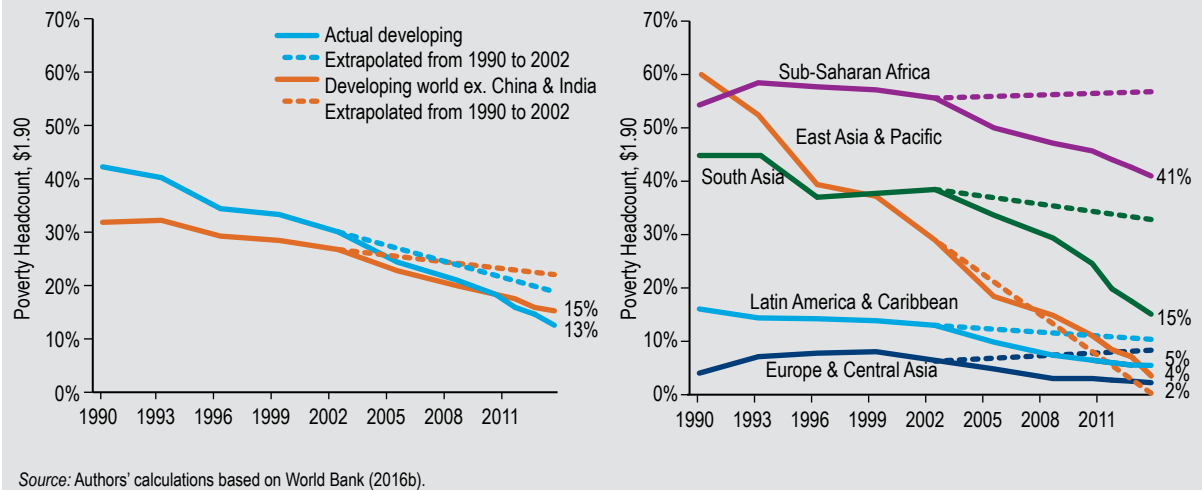
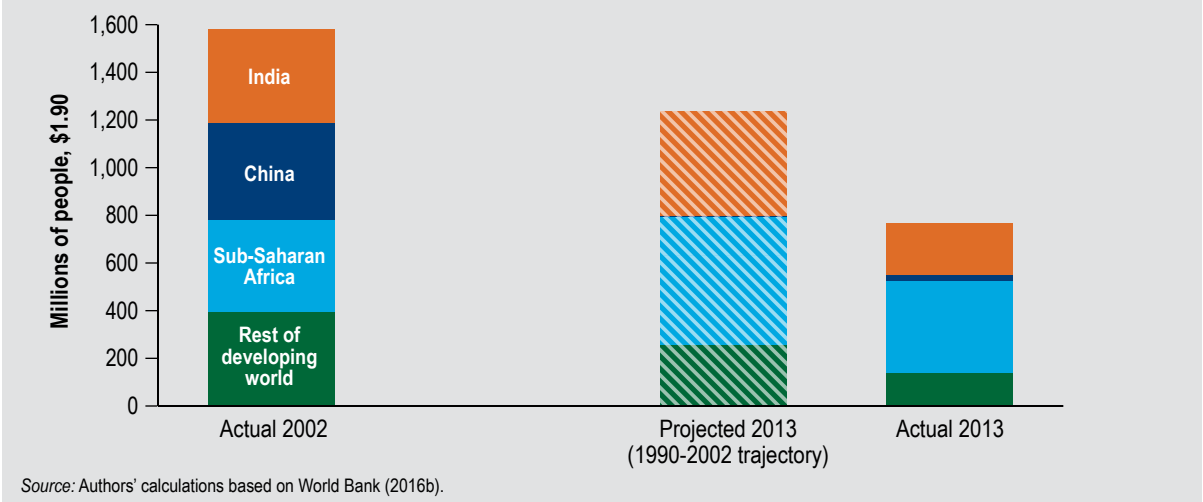


Figure 4.20: Far fewer people living in extreme income poverty as of 2013 compared to 1990-2002 trajectory



poverty in the rest of the developing world was also cut by half between 1990 and 2013, as shown by the left side of Figure 4.19. Concurrently, the right side of the same figure shows how, with the minor exception of East Asia and the Pacific, the extreme poverty rate in each major region declined compared with simple counterfactual trends as of 1990 to 2002.¹⁹

The same head-count percentage counterfactuals can be translated into absolute numbers of people in extreme poverty. Figure 4.20 presents the most recent World Bank estimates of the absolute number of people estimated to be living in extreme poverty in both 2002, on the left, and 2013, on the right. The middle bar shows a counterfactual: what the head count would

Table 4.9: Extreme income poverty: Millions of lives improved as of 2013 - or not - due to accelerated progress since 2002

	Aggregate	Geography			
	All developing	China	India	Sub-Saharan Africa	Rest of developing world
Poverty head count	471 to 610	(22) to 157	199 to 225	102 to 150	119 to 152

Notes: Calculations based on extrapolations of pre-MDG trends compared to actual reported values up to 2013. Parentheses denote negative (fewer) lives improved compared to trends. Ranges based on Counterfactual A (trends extrapolated from 1990 to 2002) and Counterfactual B (extrapolated from 1996 to 2002).

Source: Authors' calculations based on World Bank (2016b).

have looked like had each of the three geographies maintained its 1990-2002 rate of improvement on its percentage of the population living in extreme poverty all the way out to 2013. In 2002, just under 1.6 billion people were living in extreme poverty in India, China, Africa, and other developing countries. The difference between the middle and right-side bars highlights how India, Africa, and the rest of the world are both responsible for outsized gains.

Table 4.9 presents estimates of incremental lives improved due to accelerated reductions in extreme income poverty. Here we use slight variations on the pre-MDG reference dates due to World Bank reporting years; counterfactuals are based on rates of change in aggregate head-count poverty ratios from 1990 to 2002 and 1996 to 2002, respectively. This simple counterfactual method implies that somewhere in the range of 471 million to 610 million more people were living above the extreme poverty line than would have been the case under previous trajectories. This includes approximately 254 million to 268 million people outside of China and India.

For China, the counterfactuals provide a range from negative 22 million compared with its 1990-2002 trajectory to positive 157 million when compared with

1996-2002. This large spread reflects China's slowdown in progress in the late 1990s. For India, the range of incremental lives improved is much smaller—from 199 million to 225 million, approximately 16 to 18 percent of the national population. For Africa, the range is from 102 million to 150 million, representing approximately 11 to 16 percent of the population as of 2013. We are not able to calculate estimates for LIC and MIC aggregates due to country-level data gaps.

4. Natural capital

There are few reasonable country-level indicators for assessing global progress on natural capital. The MDGs included a target, originally established under the 1992 Convention on Biological Diversity, to reduce the rate of loss of biodiversity worldwide by 2010. This indicator received limited attention and was deemed not to have succeeded (e.g., Adenle 2012). The International Union for Conservation of Nature's Red List Index assesses the risk of a species going extinct over time (IUCN 2015). Across the four groups studied—amphibians, birds, corals, and mammals—it shows no turnaround in the risks of extinction since 2000. Amphibians are on average the most threatened group, while corals are moving the fastest toward extinction. Another major recent study also indicates

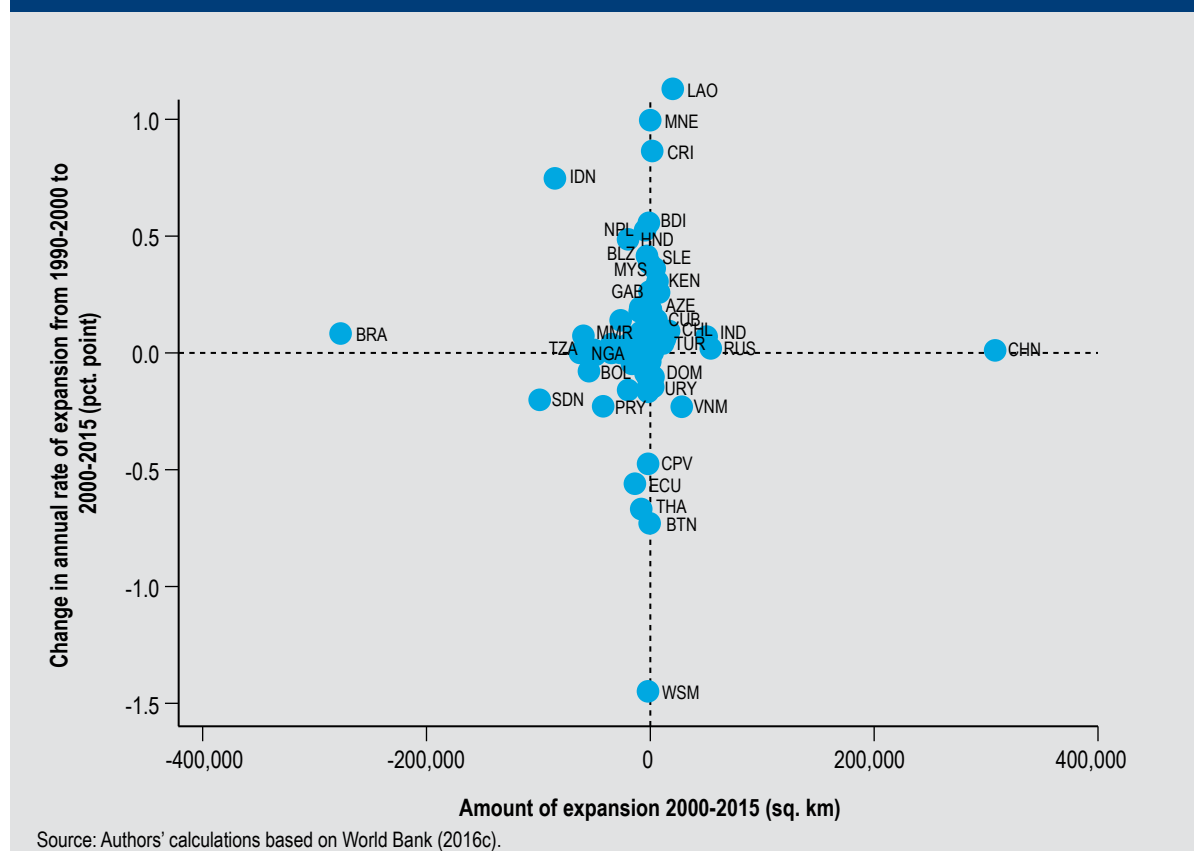
that wilderness areas have rapidly declined since the 1990s (Watson et al. 2016).

To examine country-level rates of environmental progress, we consider two imperfect proxy indicators. One is “area with forest cover,” which measures land area with trees at least 5 meters tall, excluding both agricultural production systems and trees in urban parks and gardens.²⁰ The other is terrestrial protected area as a share of total land. Both measures suggest little if any discernible overall change in average country trends. Among 150 countries with data for forest cover, positive rates of change accelerated in only 37. Of those, only six countries increased their rates of forest area

expansion by at least 0.33 percentage points per year. For protected land area, 76 of 154 countries experienced accelerated gains, but for most the acceleration was small. In only 22 countries did their rate of potential area expansion increase by at least 0.33 percentage points per year.

T-tests do not show a significant result for mean rates of environmental progress either. For forest cover, only the subsamples for LICs and Europe and Central Asia showed very small positive differences, but significant only at 10 percent levels. For protected land area, only African countries showed a small positive and statistically significant average acceleration, while East Asia

Figure 4.21: Changes in forest cover from 2000 to 2015, developing countries



and the Pacific countries experienced a statistically significant slowdown.

As further evidence, Figure 4.21 plots the absolute change in forest cover from 2000 to 2015, on the horizontal axis, against the difference in rate of progress pre- and post-MDG, on the vertical axis. The left side of the graph shows countries that lost aggregate forest cover between 2000 and 2015. The bottom-left segment shows the 26 countries whose rate of loss accelerated, while the top-left segment shows the 46 countries that had a slowdown. The right side of the graph indicates expansion in forest cover. The top-right segment captures 37 countries that experienced accelerated gains compared with the 1990s, while the bottom-right segment shows the 23 countries with slower gains. Eighteen countries experienced no change in forest cover between 2000 and 2015.

The graph highlights the fact that much of the developing world's change in total forest area is concentrated in a small number of countries. Between 2000

and 2015, for example, China's forest area increased by a reported 313,000 square kilometers (km²), while Brazil's declined by more than 277,000 km². Indonesia, meanwhile, lost 84,000 km² and Sudan lost 98,000 km². For protected land area, growth was concentrated in only a few countries. Brazil accounted for roughly a third of developing countries' net gains by increasing its protected area by more than 1.1 million km² between 2000 and 2014.

Overall, developing countries' aggregate annual rate of forest loss slowed more than 40 percent from 2000 to 2015, compared with the 1990s, but the aggregate loss since 2000 still added up to more than 700,000 km². At the regional level, net losses were confined to Latin America and Africa. As one arguably silver lining to the generally negative trend, if all developing countries had continued on their 1990s trajectories (Counterfactual A), an additional 474,000 km² of forest area would have been lost by 2015, slightly smaller than the land area of Spain.

V. SYNTHESIS

This section synthesizes some key results from the preceding analysis. To start, Table 5.1 shows the number of countries that experienced “real” acceleration on each indicator post-2000, compared to 1990s trends—defined as at least a 1 percentage point change in annual proportional progress for child and maternal mortality, or a 0.33 percentage point change in annual absolute rates of progress for other indicators. It groups results by initial income classification as of 2000, separating the LICs from the MICs. (Results by geographic region are available in Appendix 4.) The upshot is that there was clearly an acceleration in progress for both access to HIV/AIDS treatment and primary school completion rates across income levels. It is also clear that LICs had more common acceleration across indicators than MICs. Child mortality and maternal mortality made strong gains across a majority of LICs, as did undernourishment—at least among countries with available data. The evidence for both water and sanitation is less positive.

Table 5.2 synthesizes the results comparing average rates of progress between 1990-2000 and 2000-2015 (or thereabouts). The table presents results only where the difference of mean rates of progress is significant to at least 5 percent levels; otherwise the elements of the table are left blank. Blue boxes indicate a faster average annual rate of progress post-2000 and orange boxes indicate a slower rate. A positive (+) or negative (-) symbol signifies a “real” shift, defined as above. Results are shown for countries when segmented by income group or by region.

The pattern in Table 5.2 is again clear, showing that low-income countries had significant average gains in their rates of progress across most indicators, while middle-income countries had gains on only a couple.

The limited availability of country-level time-series for extreme income poverty inhibits strong conclusions. However, there is some evidence of accelerated progress in both low- and middle-income countries, even if only statistically significant among the latter. Among regions, Latin America and the Caribbean showed negative shifts in the average rate of progress on many dimensions. At the other end of the spectrum, Africa’s rates of progress accelerated on a majority of indicators.

For an overall distillation of patterns of progress, we next return to the logic of four categories of outcomes, as described at the outset in Figure 1.1. For each MDG target, outcomes should ultimately be considered based on both the amount and acceleration of progress. To this end, Figure 5.1 synthesizes population-weighted results for low-income countries (excluding India) and middle-income countries (excluding China). Figure 5.2 shows comparable results for China and India, Figure 5.3 for sub-Saharan Africa, and Figure 5.4 for Latin America and the Caribbean. Figures for the remaining regions are included in Appendix 6.

Within each graph, the horizontal axis indicates the share of each problem that was eliminated within the respective geography between 1990 and 2015. Each group’s baseline gap (e.g., percentage undernourished, without water, dying before fifth birthday, and so forth) is indexed to a value of 100, recognizing that MDG targets generally aimed to reduce each problem by 50 percent or more. To illustrate, if a population had 50 percent without access to water in 1990 and 30 percent without access in 2015, this is counted as a 40 percent reduction in the problem. The vertical axis then indicates the degree of acceleration in the proportional rate of progress pre- and post-MDGs. A ratio of 1 implies no change in the rate of progress, while a ratio of 2

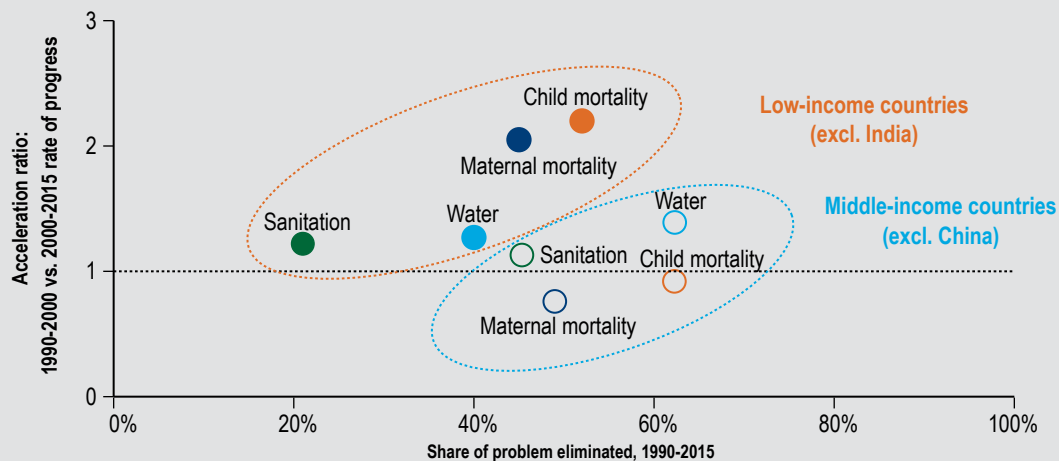
Table 5.1: Number of countries with “real” acceleration post-2000, by initial income group

		Low-income countries			Middle-income countries		
		n	yes	%	n	yes	%
Life and death	Under-5 child mortality rate	65	42	65%	89	23	26%
	<i>Estimated number of malaria deaths</i>	51	24	47%	9	4	44%
	Maternal mortality ratio	65	35	54%	82	26	32%
	Antiretroviral therapy coverage	54	53	98%	45	39	87%
Basic needs	Access to improved water source	61	11	18%	77	1	1%
	Access to improved sanitation facilities	62	11	18%	77	1	1%
	Undernourishment prevalence	55	33	60%	37	17	46%
	Primary school completion rate	40	29	73%	38	19	50%
	Gender parity index (GPI) in primary enrollment	37	20	54%	16	6	38%
Extreme income poverty	Poverty head-count ratio	11	4	–	25	11	–
Natural capital	Forest area	64	3	5%	86	3	3%
	Protected land area	65	9	14%	89	13	15%

Notes: (1) “Real” acceleration: > 1 percentage point annual acceleration for under-5 mortality, maternal mortality, and malaria, and > 0.33 percentage point annual acceleration for other indicators. (2) Progress for under-5 mortality, maternal mortality, and malaria deaths measured in proportional rate of change. All other variables measured in absolute percentage point rate of change. (3) Countries excluded from test if they are within 1 percentage point from the target as of 2000 ($\geq 99\%$ for water, sanitation, and primary completion rate; $\leq 6\%$ undernourishment; ≥ 0.96 for GPI; and $\leq 1\%$ for extreme income poverty). Countries excluded for malaria if they had <100 deaths in 2000. (4) Sample includes up to 154 UN member states classified as low- or middle-income by the World Bank in 2000.

Sources: Authors’ calculations based on UN-IGME (2015), WHO (2016a), World Bank (2016c).

Figure 5.1: Acceleration versus progress during the MDG era, by initial income group



Sources: Authors’ calculations based on UN-IGME (2015), World Bank (2016c)

Table 5.2: Changes in average country rates of progress, 1990-2000 versus 2000-2015

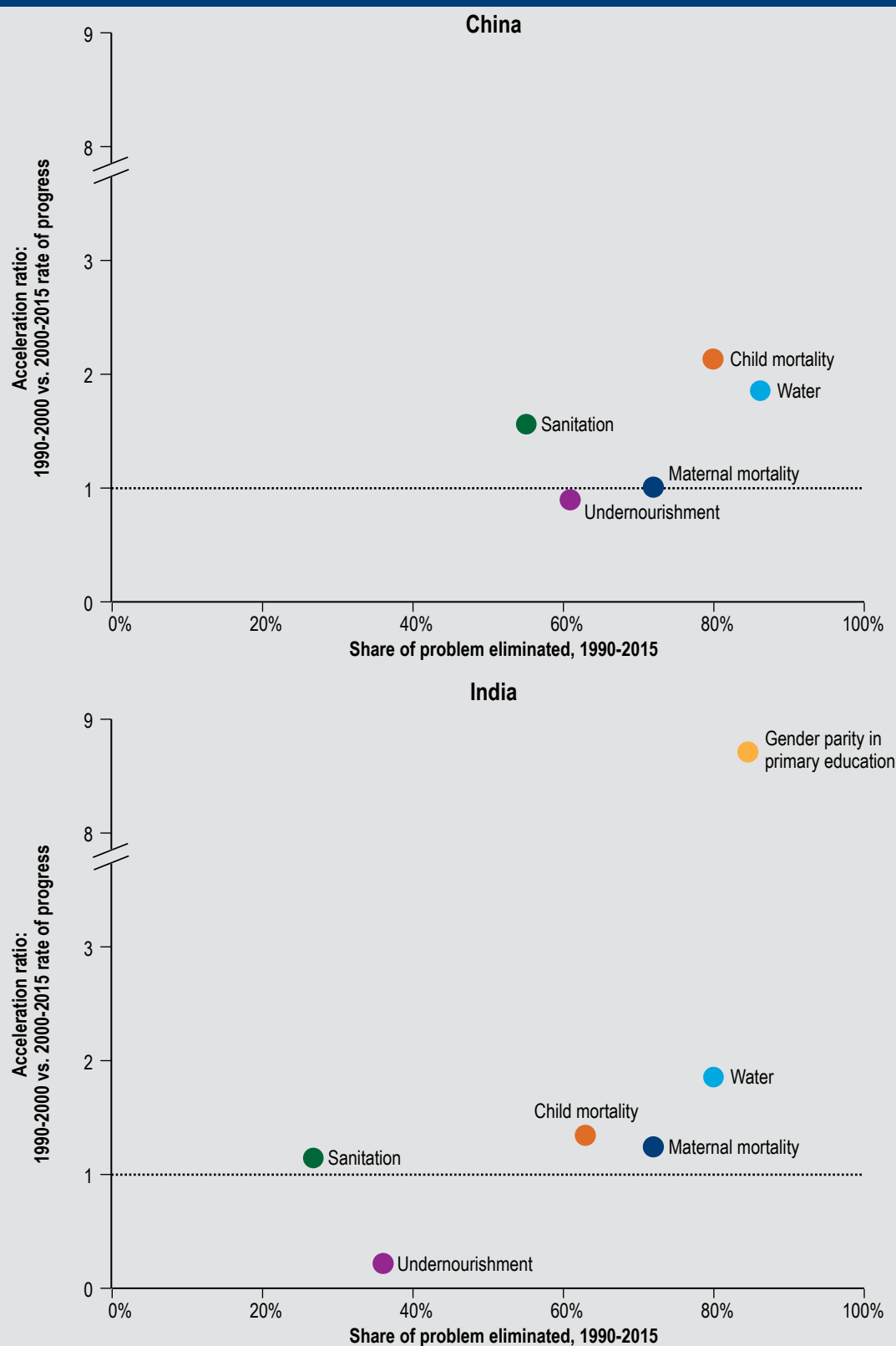
	By Income Group			By Geography					
	All Developing	Low-income	Middle-income	East Asia & Pacific	Europe & Central Asia	Latin America & Caribbean	Middle East & North Africa	South Asia	Sub-Saharan Africa
Life and Death	+	+			+				+
		+							+
Basic Needs	+	+	+	+	+	+		+	+
	+	+							+
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faster progress
 slower progress
 limited data coverage
 +/– major change in rate

Notes: (1) Shaded boxes indicate statistically significant difference ($p < 0.05$) of mean annual rates, pre- versus post-MDG adoption. The “+” and “-” symbols indicate a large change in rates, defined as >1 percentage point change in annual proportional progress for child and maternal mortality, or >0.33 percentage point change for annual absolute progress for other indicators. (2) AIDS treatment coverage compares rates of progress from 2000-2002 versus 2002-2015. (3) Extreme income poverty results based on very limited available data: 11 low-income countries and 25 middle-income countries.

Sources: Authors' calculations based on UN-IGME(2015), World Bank (2016c).

Figure 5.2: China and India – variations in progress and acceleration



Notes: China's gender parity in primary education not included due to high initial value already in 2000..

Sources: Authors' calculations based on U.N.-IGME (2015), World Bank (2016c).

implies a doubling in the rate of progress, and so forth. (Equivalent graphs based on absolute percentage point rates of progress are also included in Appendix 6.)

The figures underscore the variations in progress by issue and by geography during the MDG period. In Figure 5.1's summary by income group, we are able to calculate estimates for only four indicators—child mortality rates, maternal mortality rates, water, and sanitation—because of data availability at the country level. For China and India, the two special case large developing countries, we are able to add observations for

undernourishment, in addition to gender parity in primary education for India (China had already achieved parity as of 2000). For Africa and Latin America and the Caribbean, we are further able to include primary school completion, using World Bank regional aggregate data.

Figure 5.1 shows that much of the world's acceleration in progress occurred in LICs (outside of India), while MICs and the rest of the world (outside of China) typically had larger gains but less acceleration. Among the relevant indicators presented, the share of the prob-

Figure 5.3: Sub-Saharan Africa – widespread acceleration

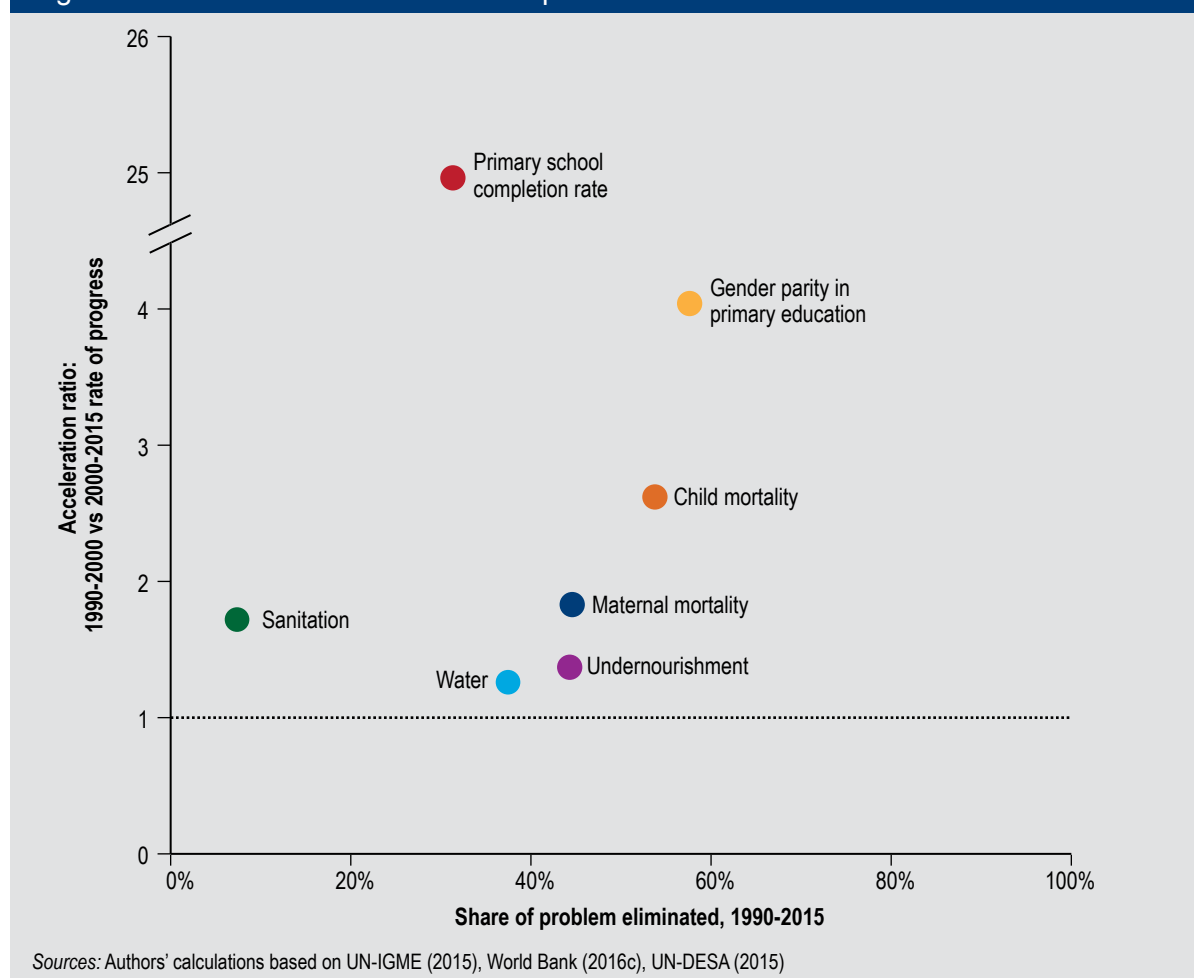
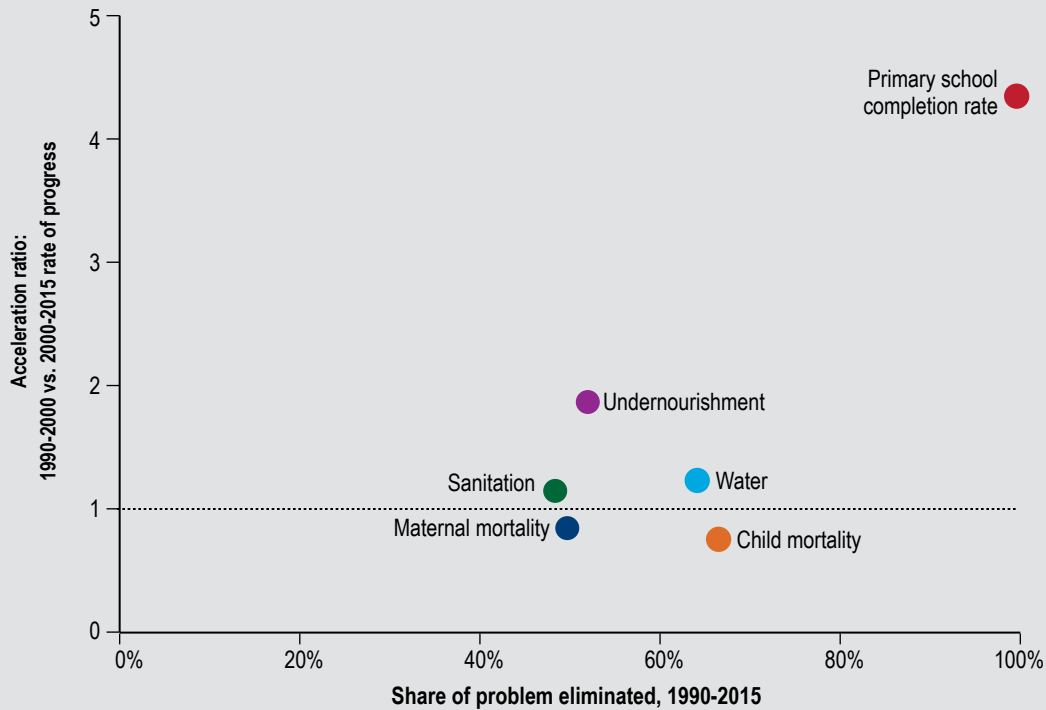


Figure 5.4: Latin America and the Caribbean – major gains, less acceleration



Notes: Gender parity in primary education is not included due to high initial value already as of 2000.
Sources: Authors' calculations based on UN-IGME (2015), World Bank (2016c), UN-DESA (2015)

lem eliminated ranged from 21 percent for sanitation in LICs to 62 percent for water and child mortality in MICs.

When looking across the synthesis figures, the results for child mortality stand out as particularly successful in terms of acceleration. The LICs, Africa, and China all experienced more than a doubling of their rate of progress after 2000, with Africa accelerating its 1990s rate of progress by a factor of 2.6. Also notable is the dramatic acceleration of Africa's primary school completion rates, in which progress accelerated more than 25-fold post-2000, and gender parity in primary education, on which the region quadrupled its rate of progress. In comparison, Latin America and the Caribbean reduced child mortality by 67 percent, but with a slow-

down compared to its previous fast rate of progress during the 1990s.

Meanwhile, access to water had only limited acceleration outside of China and India, even while making considerable gains everywhere. Access to sanitation had the greatest relative acceleration in Africa, although from a very low base, eliminating only 7 percent of the existing problem. In all groups, sanitation was the indicator lagging the furthest behind. In China and India, undernourishment had slowdowns in rates of progress and performed only slightly better than sanitation for the share of the problem eliminated. Gender equality in primary education made considerable progress in many countries.

Total lives saved and improved

Changes in country-level trajectories can be aggregated to estimate the implied numbers of lives saved. Our analysis of life and death indicators suggests that an estimated range of 21.0 million to 29.8 million lives have been saved compared with the world's pre-MDG trajectories. Overall, this amounts to 8.8 million to 17.3 million children under the age of 5; 8.7 million people infected with HIV/AIDS; 3.1 million people infected with TB; and 396,000 to 648,000 mothers. Africa was responsible for approximately two-thirds of the incremental gains, as shown in Figure 5.5; China and India were responsible for only approximately one-fifth. We estimate that progress on malaria accounted for roughly a tenth of the under-5 children's lives saved in 2013, the most recent year with available data.

Among basic needs indicators, the clear overall success story was in primary school completion rates. An estimated 59 million to 111 million more people had completed primary school as of 2013, compared with pre-MDG trajectories. On this issue only approximately a quarter of the incremental gains were achieved in Africa. The results for drinking water and undernourishment are less sanguine. Although a large number of countries experienced accelerated gains, many populous countries experienced deceleration, resulting in aggregate estimates that are either negative or indistinguishable from zero lives improved. China, India, and sub-Saharan African countries recorded modest incremental gains on sanitation, while the rest of the world in aggregate slowed down. Figure 5.6 shows our estimates for incremental lives improved (or not) by major region as of 2015, or most recent available year, compared to trends from 1990-2000.

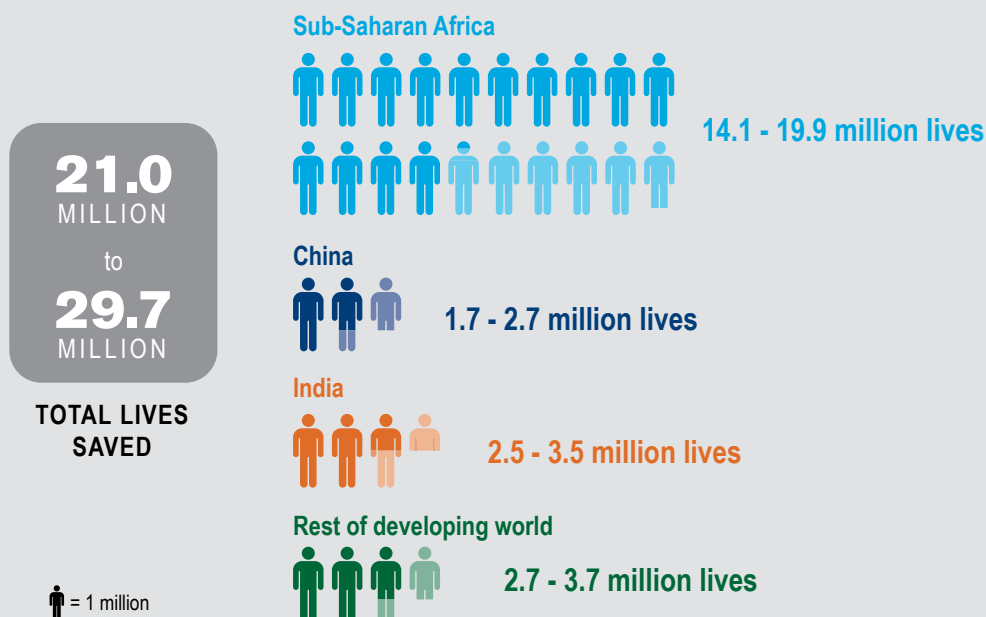
A rough estimate of extreme income poverty counterfactuals also suggests that most developing regions experi-

enced an acceleration in head-count reductions over the period since 2002. The exception was East Asia and the Pacific, notably including China, whose overall fast pace of decline during the 1990s slowed down slightly. In total, an estimated 471 million to 610 million more people are living above the extreme poverty line than would have been the case under pre-MDG trajectories. This includes an estimated 254 million to 268 million people outside of China and India, of whom an estimated 102 million to 150 million are in Africa. The right-side column in Figure 5.6 shows the incremental lives improved as of 2013, compared to 1990-2002 trends.

The variation in outcomes prompts a question of why—what drove the differences? If one presumes, for example, that economic growth is the primary driver of outcomes, then one would need to be substantiate how the same underlying patterns of growth led to such different trends across outcomes such as HIV/AIDS deaths, child mortality, primary school completion, and access to drinking water. Similarly, a hypothesis that commodity prices drove gains among low-income exporting economies would need to identify the pathways between commodity-specific price trends and the cross-section of relevant MDG indicator outcomes. Conversely, if one believes that official development assistance is a primary driver of particular results in low-income environments, then one would need to substantiate the links between issue-specific outcomes and relevant forms of public and private finance.

Importantly, the diversity of outcomes across sectors draws attention to issues that are less prone to statistical analysis, including the institutional designs and epistemic norms among different policy communities. The field of global health, for example, has undergone a major expansion of delivery-oriented international public institutions such as the GAVI Alliance; the Global Fund to Fight AIDS, Tuberculosis, and Malaria;

Figure 5.5: Total lives saved between 2000/2001 and 2015 due to accelerated progress



Sources: Authors' calculations based on UN-IGME (2015), World Bank (2016c), WHO (2016b), UNAIDS (2016b, c).

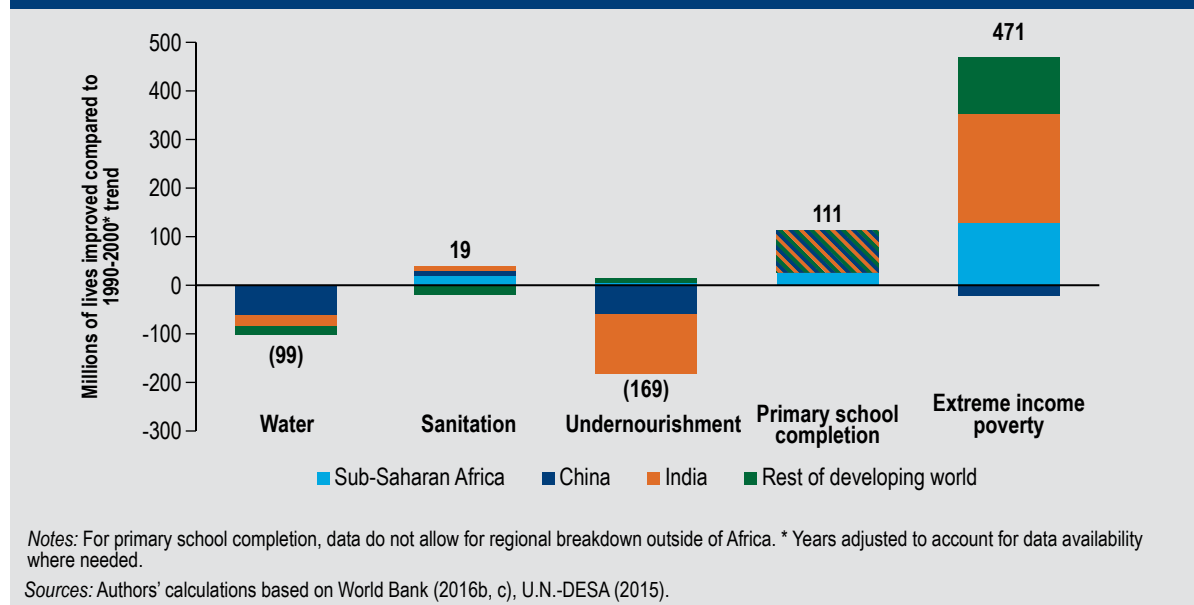
Table 5.3: Not just business as usual – millions of lives saved between 2000/2001 and 2015 due to accelerated progress

	Sub-Saharan Africa	China	India	Rest of developing world	All developing
Child mortality	7.0 to 12.6	0.9 to 1.9	1.0 to 1.9	-0.1 to 0.8	8.8 to 17.3
Maternal mortality	0.3 to 0.5	-	< 0.1	< 0.1	0.4 to 0.6
Tuberculosis	-	0.6	1.0	1.6	3.1
HIV/AIDS	6.8	0.2	0.5	1.2	8.7
TOTAL	14.1 to 19.9	1.7 to 2.7	2.5 to 3.5	2.7 to 3.7	21.0 to 29.7

Notes: Calculations based on extrapolations of pre-MDG trends compared to actual values from 2001 to 2015. Child and maternal mortality ranges based on Counterfactual A (trend extrapolated from 1990 to 2000) and Counterfactual B (extrapolated from 1996-2001). Values for TB assume deaths in each country remained constant from 2001 onward. HIV/AIDS based on estimated deaths averted due to antiretroviral therapy (ART), with disaggregation weighted by distribution of people with access to ART.

Sources: Authors' calculations based on U.N.-IGME (2015), World Bank (2016c), WHO (2016b), UNAIDS (2016b, c)

Figure 5.6: Millions of lives improved as of 2015 - or not - due to accelerated progress since 2000*



the U.S. President's Emergency Plan for AIDS Relief; and the U.S. President's Malaria Initiative. The field has also benefited from a surge in private philanthropy over the past two decades, some of which has been used to boost investments in applied research, which is published in *The Lancet* and other prestigious academic journals (McArthur and Zhang 2015). For policy

communities that have had less notable accelerations, such as for undernourishment or sanitation, questions need to be raised regarding which institutions are taking responsibility for which outcomes, and even which top-tier journals are convening the applied research debates to inform progress.

VI. CONCLUSION

This paper started by asking whether anything was different under the MDGs. Our results highlight the 2015 outcomes that were not on track to happen as of 2000. The clearest shifts in trends occurred in the poorest countries in the realm of life and death issues—most notably child mortality, maternal mortality, and infectious diseases including AIDS, TB, and malaria. Many of those same countries, especially in Africa, had by far the greatest accelerations in rates of progress during the 2000s. Low-income countries outside of India accounted for more than three-quarters of the estimated range of 21.0 million to 29.7 million incremental lives saved overall. China and India account for only around 20 percent of the overall additional lives saved due to acceleration.

More profoundly, the period since approximately 2000 is the first one in recorded modern history (i.e., since the 1950s) during which countries at all levels of child mortality are making the same average rate of progress. On global health outcomes, the MDG era might have been the most successful period in history. The challenge is that the world promised to do even better.

The story for basic needs indicators is more nuanced. The developing world was already making steady aggregate gains on such issues as undernourishment and access to drinking water prior to the establishment of the MDGs, and these trends continued at a generally consistent rate. However, what did change for these issues was an apparent average acceleration in the rate of progress across low-income countries and African countries, even if not always in the most populous countries.

The positive exception among basic needs indicators was primary school completion rates, on which

developing countries are estimated to have experienced a 0.69 percentage point faster average rate of progress after 2000 (noting that this indicator does not measure learning outcomes). Meanwhile, gender parity in primary education accelerated in a majority of relevant countries. The clear laggard among basic needs indicators was sanitation, which generally continued slow progress in LICs, even if accompanied by a modest acceleration. The data do not suggest that the world is making adequate progress to solve the global sanitation problem anytime soon (see McArthur and Rasmussen 2016 for more details on current trajectories out to 2030).

We consider extreme income poverty separately as a special category of MDG-related issue. Although this indicator is subject to complex measurement dynamics, available data suggest that all regions except East Asia and the Pacific had accelerated gains in headcount poverty ratios declines after the MDGs were established. When excluding China and India from the equation, the rest of the developing world likely cut extreme poverty from approximately 32 percent in 1991 to 15 percent in 2013.

The clearest shortcomings during the MDG era were in the realm of environmental sustainability. The 2010 target for biodiversity loss did not succeed. There was little overall progress on proxy indicators such as forest cover and protected land area. One could find mild solace in the finding that things would have been even worse if all developing countries had continued on their 1990s trajectories, since an aggregate forest area nearly the size of Spain would also have been lost.

Our analysis draws attention to issues of data quality and availability. In attempting to assess trends during the MDG era, we found that many key observations are missing, many are likely subject to measurement

error, and many will likely be revised in coming years. All of this motivates a considerable degree of caution not to interpret any of our results with false precision. They are presented only as best estimates given the information available. There remains a clear need for an SDG “data revolution.”

The variation in outcomes during the MDG era also draws attention to variations in performance across issue-specific international policy systems. They further prompt questions around inherently complex notions of public responsibility. When the world sets goals like the MDGs—or now the SDGs—who is responsible for each component that feeds in to progress, ranging

from research to evaluation to advocacy to financing to policy design to implementation? Who should be celebrated when complex systems generate unprecedented outcomes? Who should be accountable when populations fall short? Who should be held responsible for the adequacy of data even to assess progress?

Such questions of causality and accountability ultimately lie beyond the scope of this study. But the paper’s results can nonetheless help inform assessments of how and where the world’s patterns of progress changed during the MDG era. Some of the shifts were dramatic. Learning from them is crucial for generating the world’s next batch of needed breakthroughs.

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ENDNOTES

1. We have elsewhere documented (McArthur and Rasmussen 2016) the accelerated nature of progress required for several extreme poverty-related SDG targets to be achieved by the 2030 deadline.
2. Based on the population-weighted results in their Table 8 on page 20.
3. Kenny and Sumner reported an “actual” CMR of 51 deaths per 1,000 live births in 2009, but the official value reported at the time was 66 per 1,000 live births according to U.N.-IGME (2010), the underlying source for the World Bank data which they used.
4. The World Bank’s operational policies divide countries into IDA, IBRD and Blend countries. The International Development Association (IDA) is the arm of the World Bank that provides the most concessional forms of financing to the poorest countries. The International Bank for Reconstruction and Development (IBRD) is the arm that provides loans to countries with higher per capita incomes and better credit ratings. Blend countries are those that are eligible for IDA financing and also eligible for IBRD loans.
5. For example, there is no country-level under-nourishment data for populous countries such as the Democratic Republic of the Congo, Somalia, South Sudan, and Sudan.
6. We test for “real” acceleration by considering a threshold of at least a 1 percentage point annual acceleration in the proportional rate of change for mortality indicators and a 0.33 percentage point acceleration in the absolute percentage point rate of change for all other indicators.
7. For example, You et al. (2015), Wang et al. (2014), Kassebaum et al. (2014), and Kenny and Sumner (2011) all use proportional rates of change for mortality indicators. Kenny and Sumner (2011), meanwhile, use percentage point rate of change for primary education and gender equality. Fukuda-Parr et al. (2013) uses percentage point rate of change for many indicators and also proportional rate of change for under-5 mortality.
8. As a note on language, the technical measure of maternal and child mortality is the “mortality rate,” with “rate” in that term referring to deaths *per number of births*. This is distinct from the “rate of change” *per year* that we emphasize throughout the paper, i.e., the rate of change in the mortality rate.
9. Technically-minded readers might wish to compare the LIC trend in Figure 4.3 to the earlier conceptual illustration in Figure 2.1.
10. The WHO reports that, in 2015, approximately 69 percent of malaria deaths around the world occurred in children under 5; http://www.who.int/malaria/areas/high_risk_groups/children/en/ (accessed August 18, 2016).
11. Some leaders in early MDG policy efforts also played a key role in the April 2000 African Summit on Roll Back Malaria, which adopted the Abuja Declaration and constituent targets a few months before the Millennium Summit. But it was not until early 2005 that MDG-linked public campaigns and policy effort brought widespread global public attention to the opportunities for progress on malaria. The WHO then adopted a mass distribution policy for bednets in August 2007 after early trials in Kenya and debates in Tanzania; the U.N. secretary-general created a special envoy position focused on malaria in February 2008; and the Global Fund to Fight AIDS, Tuberculosis, and Malaria expanded its funding for malaria control considerably over the latter half of the 2000s.
12. To put that 180,000 figure for 2013 in context, the lives of approximately 1 million incremental children under-5 were saved overall that same year, according to Counterfactual B as described earlier.
13. This calculation represents an approximation of actual lives saved, since the same woman might have given birth more than once during the period.
14. Because of data limitations and the need for complex epidemiological assumptions around the nature of spreading diseases, we do not calculate in-

dependent counterfactuals for HIV/AIDS. Instead in Table 4.4 we replicate the reported number of overall “deaths averted due to treatment” in UNAIDS (2016b) and estimate the geographic composition of this aggregate based on country-level data for access to treatment from UNAIDS (2016c).

15. It is also more conservative, for example, than the counterfactual trajectories indicated for sub-Saharan Africa in Box 2.1 of the World Bank-IMF *Global Monitoring Report 2015/2016*.
16. For completeness, Appendix 6 shows data in terms of annual proportional changes, too.
17. Eighty-one countries in our sample reported values of 0.96 or greater as of 2000.
18. India was one of the notably successful accelerating countries. It had a secondary GPI of 0.71 in 2000 and was on a trajectory to reach 0.89 by 2015. Instead it achieved parity by 2013, with both males and females equally enrolled at a rate of 69 percent.
19. We underscore that more rigorous counterfactuals would require more detailed and debatable assumptions regarding the specific poverty gap and distribution of consumption growth in each country.
20. We also considered freshwater withdrawal as a share of total renewable water resources, but large gaps in country data coverage prevented us from including it in the analysis.



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