ADVANCING GLOBAL EDUCATION: FORECASTING THE NEXT 50 YEARS

PATTERNS OF POTENTIAL HUMAN PROGRESS

VOLUME 2

EXECUTIVE SUMMARY

Janet R. Dickson
Barry B. Hughes
Mohammod T. Irfan

PARDEE CENTER for International Futures

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The Patterns of Potential Human Progress (PPHP) series is the work of the Frederick S. Pardee Center for International Futures at the University of Denver's Josef Korbel School of International Studies. The PPHP series is jointly published by Paradigm Publishers and Oxford University Press India. This executive summary of the second volume in the series, *Advancing Global Education: Forecasting the Next 50 Years*, was prepared by Janet R. Dickson.

Cover Art

The cover art, an oil painting by Margaret Lawless, represents many elements related to the theme of advancing education across the globe. The processes of education require the interaction of adults and young people within the home and community as well as in the school. The diversity of human figures captures the diversity of human populations and of participants in the educational process. The division of education into levels—primary, secondary, and tertiary—is now all but universal, although the precise specifications of the levels and periods spent in each vary. The upward sloping path of the picture represents not just the progression of people through stages of education, but also the broader concept of progress that the PPHP volume series explores. It even hints at the S-shaped character that transitions in human development so often follow. The transformation of the global human condition to long-term, sustainable well-being encompasses many such transitions, and they are a pervasive theme and image for the work of the Pardee Center for International Futures.

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Preface

Advancing Global Education: Forecasting the Next 50 Years is the second in a series of volumes on **Patterns of Potential Human Progress** (PPHP), a series that explores prospects for human development and the improvement of the global human condition. Each volume considers one key aspect of how development appears to be unfolding globally and locally, how we would like it to evolve, and how better to assure that we move it in desired directions.

The volumes emerge from the Frederick S. Pardee Center for International Futures at the University of Denver's Josef Korbel School of International Studies. The International Futures (IFs) modeling and analysis project has worked for three decades to develop and use the strongest possible global, long-term, multiple-issue capability for exploring the future of global issues. The philosophical foundation of the IFs project includes these beliefs: prediction is impossible, but forecasting is necessary to understand change and to support policy development; analysis should be built around alternative possible futures; and tools for forecasting should be as fully open and transparent as possible.

The IFs system of models and its applications are continually evolving. Even so, the structural foundation of the system continues to build on two core characteristics:

1. it is long-range (its forecasting horizon extends to the year 2100), and
2. it encompasses multiple domains of human and social systems for 183 countries (e.g., population, the economy, health, education, energy, agriculture, and aspects of socio-political systems) and the interaction effects among them.

The first volume in the PPHP series was dedicated to the issue of global poverty reduction. The second volume—the subject of this executive summary—explores what is arguably the most important option for consciously making the future better than the past: the expansion of education opportunities and levels of education attainment across the globe. The third volume focuses on improving global health. Subsequent volumes will focus on strengthening global infrastructure and exploring global governance.

Advancing Global Education

A remarkable transition in global patterns of participation in education is underway—a transition that, at least on the timescale of most historical human change, is moving with quite incredible speed toward women's and men's universal basic education (primary plus lower secondary levels) and literacy. The century of change between 1960 and 2060, the focal horizon of this volume, promises to be of historic importance in the expansion of education participation and attainment.

Advancing Global Education: Forecasting the Next 50 Years attempts to extend understanding of the global education transition by addressing three central questions:

- How has the transition been unfolding, and where will we be in 2060 if current expansion paths continue to unfold? (This analysis represents our *base case*.)
- Can the transition be further accelerated and, if so, by how much? (This analysis builds and presents a *normative scenario*.)
- Are the incremental costs of the accelerated normative scenario warranted in terms of economic returns and progress in other dimensions of human development?

The executive summary begins with key messages about longer-term global education futures—the education transition itself; the context for explorations with IFs; and, most important, the implications of a base case and a normative scenario on education participation and attainment rates and human development more broadly. These messages are followed by a brief discussion of where we are in the education transition, what global education levels might look like by midcentury under a base case that builds on recent dynamic patterns, and what it might look like under a normative scenario, intended to be aggressive but realistic, across levels of formal education. The analysis identifies key issues that will drive education outcomes (e.g., the size of school-age populations and education financing) and includes consideration of the impacts of advances in education on economic growth and other aspects of human development. The document concludes with an overview of the IFs system of models and the education model in particular.

For more information about IFs and the PPHP series, as well as technical documentation of the model, go to www.ifs.du.edu or email pardee.center@du.edu. The PPHP volumes may be downloaded from www.ifs.du.edu, and the IFs forecasting system is also freely available.

Key Messages

The Education Transition

- *The education transition is in reality a set of interrelated transitions, beginning with an increase in education participation at the primary level and subsequently extending across secondary and tertiary levels, with lagged changes in the education attainment levels of adults.* The education transition began in today's industrialized countries during the nineteenth century and has been spreading across developing countries and regions since about 1950.

- *There are general patterns to the education transition, but it does not proceed at a constant pace across the long time span it requires.* Demographics, economic circumstances, and socio-political conditions as well as "political will" impact the pace of the transition. The 1960s and 1970s were a period of especially rapid growth in student enrollment rates and numbers in developing countries, many of whom struggled to maintain those gains during the 1980s and the first half of the 1990s. Increases in enrollment rates have accelerated again since that time.

- *Ultimately, the transition that matters most for human development and well-being is increasing the education attainment levels of adult populations.* The transition of societies from low to high levels of education attainment is an especially slow process, with at least a century-long scale. This transition is dramatically underway almost everywhere as the result of the remarkable increases in school participation rates since the mid-1960s.

- *With the exception of gender parity, which extends to all levels of education, global goals to date have focused on the primary level. Universal primary education (UPE) was first stated as a global goal with a specific target date (1980) at a series of regional conferences convened by UNESCO during the 1960s; as one of eight current Millennium Development Goals (MDGs), UPE now has a target date of 2015.* Even though global enrollment goals other than gender parity have addressed only primary education, every global region—including high-income regions—had significant gains in participation at more than one level of education between 1960 and 2005.

Forecasting Education Participation and Attainment

- *Rather than focusing only on primary education, we use IFs to look across all levels of education, both because there are pressures on subsequent levels as enrollment and completion rates reach certain points at immediately preceding levels, and also because the completion of basic education (primary plus lower secondary levels) is widely regarded as essential to literacy, numeracy, and informed citizenship.* The participation of at least some proportion of adults at the more specialized upper secondary and tertiary levels also is critical for individual opportunity and societal well-being.

- *Enrollment levels are the result of intake rates at the primary level, persistence ("survival") rates through primary grades, and then transition rates to subsequent education levels and persistence through them. Efforts to accelerate the advance of education need to look specifically at these components of enrollment and their interactions, and we do so in the IFs model.* Especially rapid increases in intake rates without simultaneous attention to the circumstances that encourage and enable persistence may actually result in lower enrollment rates, as well as personal frustration and societal unrest. Lack of attention to interaction effects across levels can also result in negative outcomes, including lack of societal strategies and preparedness for increased demand for education at postprimary levels.

- *We first develop a base case that explores the future course of the education transition if "typical" relationships between driving variables and education outcomes pertain, although we modify those typical relationships with an upward "societal shift" that reflects the ideational push of recent global goals.* The primary driving variables in our formulations are demographics (particularly age cohorts by sex and education status) and economic growth.

- *We then explore the interaction between growth rates in intake, persistence, and transition to subsequent education levels, and develop a normative scenario that accelerates the education transition through aggressive, but reasonable, targets for annual growth at primary, lower secondary, and upper secondary levels.* We conclude by comparing the education and other outcomes of the accelerated normative scenario (e.g., more rapid fertility reductions, smaller school-age cohorts, and increased GDP and GDP per capita) with the outcomes of our base case.

Education and Human Development Futures: Where are We Headed?

- *Because of vast country-level differences in enrollment rates in 2000 (the year the Millennium Development Goals were set), reaching the MDG of universal primary education by 2015 is not, and never was, a realistic goal for all*

countries. Although most countries will have achieved at least a 90 percent primary net enrollment rate by 2015, the IFs base case identifies 37 that may not. In fact, 27 of these may not reach 90 percent by 2030, including some whose recent gains have been so rapid that we question whether they can be sustained.

- *The IFs base case also suggests that, despite much progress, many countries will lack female gender parity in enrollment rates at one or more levels of education in 2015, and that not until about 2060 will the education attainment levels of adult women almost everywhere be approaching equality with those of men.* We note, too, that as the battle for female parity finally overcomes generations of imbalance in access to school, male gender gaps in enrollment rates are increasing as female persistence and transition rates outstrip those of males in a number of countries, especially at the tertiary level.

- *Our normative scenario has the biggest impact on education participation in sub-Saharan Africa, followed by South and West Asia, where it would cut about one generation off the period that the populations of those regions are otherwise likely to need in order to move beyond UPE to universal basic education and to high participation rates at the upper secondary level.* The normative scenario also accelerates such progressions across much of the rest of the developing world, albeit to a lesser extent.

- *The normative scenario has large cumulative incremental costs over the forecast period ($3.6 trillion). However, because of greater economic growth from education's effect on productivity, our analysis suggests that by 2060 the cumulative global gains in GDP from the normative scenario would be 5.6 times greater than the cumulative incremental expenditures it would require.* The difficulty for policymaking is the substantial time lag between the incremental expenditures and the greater resources from higher growth.

- *The next global goal is likely to be universal lower secondary participation for the completion of basic education. In 2005, the global lower secondary gross enrollment rate was already 82 percent. In our normative scenario, we forecast it could be 90 percent as early as 2012, and 97 percent by 2018.* Gross enrollment rates typically rise rapidly when enrollment opportunities first open up at a given level because of "over-age" students in a catch-up mode, and we should expect it would be many years more before net enrollment rates would approach universality. Even so, this forecast suggests a quite-near horizon for the approach of universal basic education.

- *The further spread of education will be helped tremendously by changing demography; demographic pressures on education are waning almost everywhere.* Even in the 14 sub-Saharan African countries with the highest fertility rates, the size of the school-age population relative to working-age adults has already begun to decline and will continue to do so for many years to come.

- *Despite the boost from smaller school-age populations relative to overall population size, the future of education will not be without its challenges.* One is the great effort required to enroll the last 10 percent of primary school-age children (e.g., those in extreme poverty, remote areas, or marginalized populations). Another is sustaining funding as demand for education increases at all postprimary levels. And the third, without which the education transition has no hope of reaching its potential, is investment in education quality.

The Story of Global Education

The Story So Far

Overview

The United Nations Universal Declaration of Human Rights (1948) asserted that access to education, including free and compulsory primary education, is a basic right of every individual. The assertion contributed to the acceleration of a long and ongoing education transition, expressed in expanding access to, and attainment of, formal education.

The magnitude of the education transition since 1950 has been extraordinary. The global primary gross enrollment rate was 58 percent in 1950; at the secondary level it was 12.7 percent, and at the tertiary level just 1.4 percent.[1] By 2005, only 55 years later, global gross enrollment rates had moved strikingly higher: to 101 percent at the primary level, 70 percent at the secondary level, and 31 percent at the tertiary level.

Figure 1 displays gross enrollment rate patterns by region[2] at primary, secondary, and tertiary levels between 1960 (the first year for which country-level gross enrollment data are readily available through UNESCO) and 2005. These patterns offer a number of insights and conclusions:

- Growth—often dramatic growth—in enrollment rates at more than one education level is apparent over the period in every region.
- The 1960s and 1970s were a period of especially rapid growth in student enrollment rates and numbers. Many countries struggled to maintain those gains during the 1980s and the first half of the 1990s, but increases in enrollment rates have accelerated again since then.
- Even though growth has taken place mostly at the primary and secondary levels in developing countries, within developing regions we can see evidence of different strategies for expanding education, with a push at the secondary level occurring at different times in relation to primary level enrollment rates.
- The two higher-income regions greatly increased their enrollment rates over the period at the secondary level, and even more at the tertiary level—from 10 percent to 60 percent in East Asia and the Pacific (Richer) and from 20 percent to almost 75 percent in North America and Western Europe.[3]
- The ongoing education transition in North America and Western Europe perhaps will be surprising to some. These industrialized countries began an education transition in the nineteenth century; even so, their regional secondary gross enrollment rate was only 40 percent in 1960. Their continuing transition reflects the time that it takes for societies to "gear up" for large numbers of students at higher levels; some other part almost certainly reflects a need for greater levels of education in today's technology-dependent globalized world.
- Despite remarkable gains in every region over this period, education participation still differed markedly across regions in 2005, particularly at secondary and tertiary levels. South and West Asia and sub-Saharan Africa began the period with the least participation and, despite their large gains, both ended the period in the same position. In fact, sub-Saharan Africa's secondary enrollment rate in 2005 remained lower than the secondary enrollment rates of the higher-income regions 45 years earlier.

We group countries by World Bank income levels rather than geographic regions in Table 1. We again are looking at enrollment rates in 2005 (net rates at the primary and secondary levels, and gross rates at the tertiary level), but this time for females and males separately. The relationship between country income level and education participation rates is striking and unvarying. High-income countries show high levels of participation at all levels, with upper-middle-income countries moving toward those levels. Lower-middle-income countries are nearing universal enrollment at the primary level and have reached significant levels of secondary enrollment, but their tertiary enrollment levels are still below 20 percent. It is the low-income countries that are still well short of universal primary enrollment and have a lower than 40 percent secondary enrollment rate and single-digit tertiary rates.

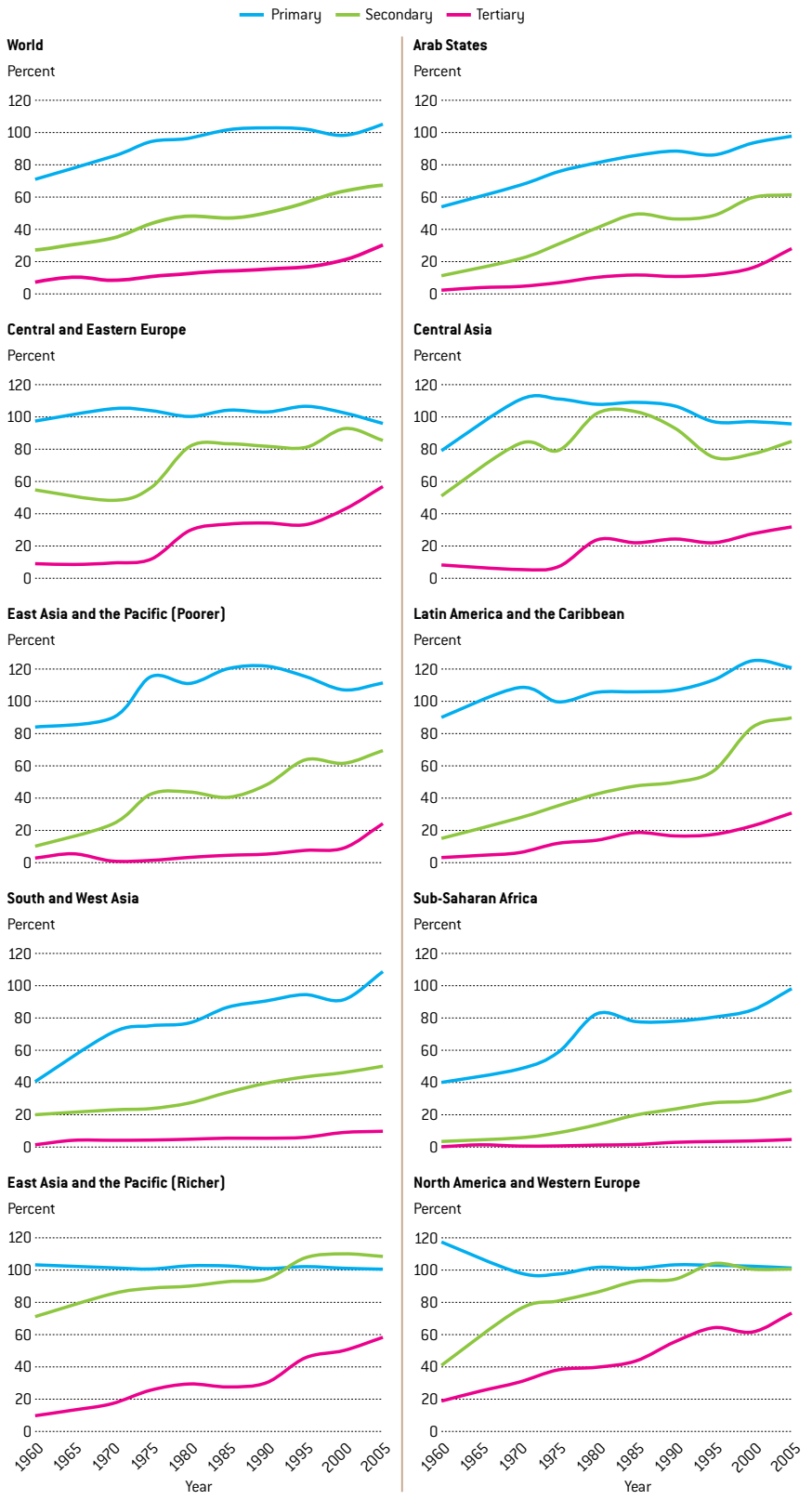
Gender participation patterns also vary across country income levels. Historically, in low-enrollment and transitional environments, boys and

1 Gross enrollment rates refer to the enrollment of all students as a percentage of the population in the age group defined by an education system as "of-age" or "on time" for that level of education; the rate can exceed 100 percent because some enrolled students are younger or older than the defined age range for the education level in question. Net enrollment rates, on the other hand, refer only to the enrollment of individuals who are "of-age" for a given level of education.

2 We began with UNESCO's regional groupings but made an exception in our treatment of countries in East Asia and the Pacific. Although UNESCO combines all East Asian and Pacific countries into one group, we separated Australia, Japan, Republic of Korea, New Zealand, and Singapore into a group we call "East Asia and the Pacific—Richer" because of their very different education and economic patterns from the other East Asian and Pacific countries ("East Asia and the Pacific—Poorer" in IFs). In all presentations of regional data and forecasts, we first list the developing regions (in alphabetical order) and then the two higher-income regions (East Asia and the Pacific—Richer, and North America and Western Europe).

3 The tertiary gross enrollment rate includes all enrolled students, including adults of any age, as a percentage of the population 18 to 22 years of age. An individual who pursues two or more graduate programs sequentially is included each time she/he is enrolled. All types and levels of tertiary education are included, from technical and "occupationally specific" programs to programs that lead to an "advanced research qualification" (see www.uis.unesco.org/glossary).

Figure 1 Gross enrollment rates by level and region: 1960—2005



Source: IFs Version 6.12 using UIS data.

men have enrolled in higher (often far higher) proportions than girls and women, and the goal of gender parity has been to equalize opportunities for girls and women. In the low-income group, females were not yet at enrollment parity (typically defined as female enrollment rates at 97–103 percent of male enrollment rates) at any level in 2005. In the lower-middle-income country group, females had achieved enrollment parity except at the tertiary level. The picture changes for the upper-middle-income and high-income country groups, where females not only had parity at primary and secondary levels but, in addition, far exceeded male enrollment rates at the tertiary level.

The phenomenon of growing male gaps is receiving increasing attention. We know from UNESCO Institute for Statistics (UIS) data that males repeat grades more frequently than females. We also know from UIS data that the transition rates and persistence rates of males progressively fall behind those of females across levels of education. In fact, females have higher enrollment rates at upper secondary and tertiary levels in some countries that still have higher male primary level intake rates. Another aspect of the phenomenon at the tertiary level is that women in many countries are in a catch-up mode, attending college as adult learners more frequently than men.

Figure 2 shows a distribution of reporting countries by region in 2005 according to their gender parity status—that is, the proportion of countries with parity, the proportion with a female gap, and the proportion with a male gap. Although the figure does not indicate the degree of the disparities within countries, the distributions themselves help us understand something about regional profiles of gender patterns and the extent to which regional aggregations may mask underlying disparate patterns (e.g., in regional data, a country with a female gender gap may be statistically "neutralized" by a country with a male

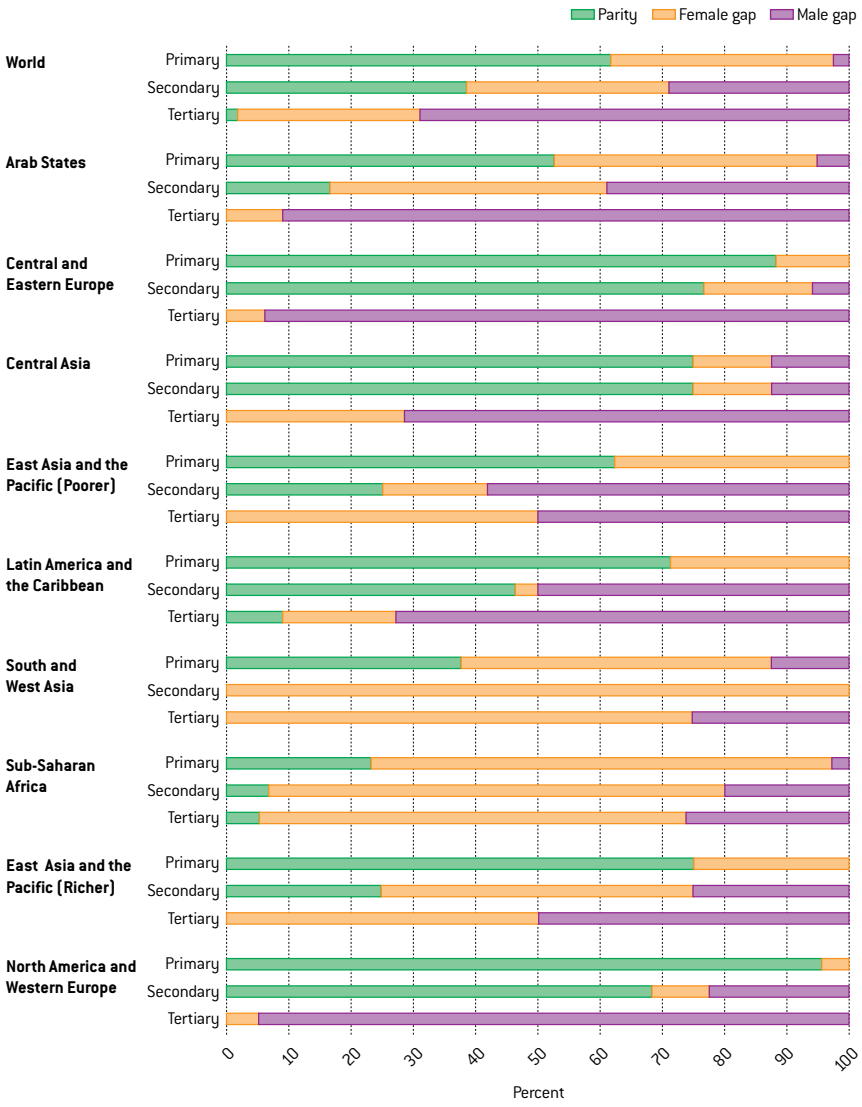
Table 1 Enrollment rates by country income, level of education, and sex: 2005

	Primary		Secondary		Tertiary	
	Female	Male	Female	Male	Female	Male
Low-income countries	67.5	75.8	31.2	36.1	4.7	7.3
Lower-middle-income countries	89.0	91.4	63.2	63.1	16.4	18.1
Upper-middle-income countries	93.8	94.0	73.7	75.0	50.6	41.3
High-income countries	95.9	95.5	90.9	89.1	75.0	61.7

Note: Primary and secondary enrollment rates are net; tertiary are gross.

Source: IFs Version 6.12 using UNESCO Institute for Statistics (UIS) data organized by World Bank country income classifications.

Figure 2 Percentages of countries by region with gender parity and gender gaps by education level: 2005



Note: Percentages are based on gross enrollment rates; not all countries reported at all levels.

Source: IFs Version 6.12 using UIS data.

gender gap or a large country with parity may mask disparities in several smaller countries).

The patterns of parity and disparity in Figure 2 vary dramatically by education level. Although a majority of countries showed parity at the primary level, 38 percent still showed a female gap, whereas male gaps were almost nonexistent. At the secondary level, only 39 percent of countries reported gender parity, and the sizable proportion of countries with female and male gender gaps was almost equal (32 percent and 29 percent, respectively). The most dramatic picture was at the tertiary level, where only 2 percent of countries reported parity and a full 69 percent reported male gaps in enrollment rates.

Base Case Forecast of Global Education Futures

Drivers of the education transition and the IFs approach

The education transition has been aided—and also sometimes constrained—by various demographic, economic, and socio-political patterns and events during the historical period of our focus. Demographically, the number of school-age children and youth affects the difficulty or ease with which a country is able to expand access to education. Even more important than absolute numbers of children and youth is their proportion relative to both working-age populations and older (also dependent) populations—a school-age population that is growing relative to the economically active population and older populations places special stresses on a society seeking to enhance education participation, while one that is decreasing relative to other age groups (e.g., when fertility rates decline and/or more children survive into adult working years) requires fewer resources and thus aids the education transition.

Similarly, alternating periods of robust economic growth (the 1950s and 1960s) and constrained economic conditions (much of the 1970s and 1980s) affect the

ease or difficulty with which education expands (see again Figure 1 for enrollment patterns across those years). Socio-political events during the period as disparate as decolonization, the waxing of the Cold War, and the changing status of women have stimulated education's expansion, while in some countries prolonged periods of turmoil and state failure have had a decidedly negative effect. In combination, demographics, economic circumstances, and socio-political events profoundly affect the ease or difficulty with which a country enters and proceeds through the multiple stages of the education transition—although "political will" is an important factor, it cannot carry the day on its own.

The education transition typically displays a sequential (albeit overlapping) pattern of progress across levels of education that is a multi-generational process, no matter how fortuitous the environmental context. Clemens used the term "blistering speed" to describe the rate at which developing countries today are proceeding toward universal primary education compared to the industrialized countries during their transitions in the nineteenth and early twentieth centuries.[4] Even so, his analysis suggested it takes 58 years for a country to go from a 50 percent primary net enrollment rate to a 90 percent rate.[5] And a study by Wils, Carrol, and Barrow of 70 developing countries found an average 88-year interval between 10 percent of the population completing the primary level and 90 percent doing so.[6] Large-scale transitions in secondary and tertiary participation require substantial extensions of this already prolonged period.

The IFs forecasting system of models is especially well-suited to explore large-scale social changes such as the education transition. IFs is structured to provide long-term forecasts (in this study it forecasts to the year 2060), and rather than being extrapolative in its approach, it represents the dynamic connections between multiple systems (e.g., demographic, economic, socio-political, and educational) within and across 183 countries. Thus, IFs allows the kind of analysis that suggests how long it might take individual countries to reach various levels of education participation and attainment based on highly varying circumstances in different countries.

In the pages that follow, we look first at a base case that suggests the future course of the education transition if "typical" relationships between driving variables (primarily economic and demographic) and education outcomes pertain, modified by an upward "societal shift" that reflects the ideational push of recent global goals, such as the Millennium Development Goal of universal primary education by 2015. We then explore a normative scenario that asks if and how already generally rapid rates of transition might be accelerated. In both cases, we model all levels of formal education—including the separation of secondary education into lower secondary and upper secondary levels—and the dynamic connections across them. We also model education costs and the availability of public funding.

What does a base case education future look like?

*Enrollment rate patterns***.** IFs base case forecasts for primary, lower secondary, upper secondary, and tertiary gross enrollment rates to the year 2060 are presented by region in Figure 3. What general conclusions might we draw from this figure?

- The global primary gross enrollment rate now exceeds 106 percent and is likely to decline somewhat as the enrollment rates of "of-age" children continue to increase and those of "over-age" children decline. Even so, as we will discuss in conjunction with Table 2, the world will not see universal primary education by the MDG target date of 2015.
- By midcentury, the global lower secondary gross enrollment rate likely

Table 2 Primary net enrollment rates by region: Base case forecast

	2005	2015	2030	2045	2060
Arab States	81.9	88.1	95.0	98.2	99.6
Central and Eastern Europe	89.9	98.8	100.0	100.0	100.0
Central Asia	84.4	91.8	98.5	100.0	100.0
East Asia and the Pacific (Poorer)	88.0	95.6	99.4	99.8	100.0
Latin America and the Caribbean	93.7	96.8	99.0	99.5	99.7
South and West Asia	85.5	88.3	94.0	97.9	98.6
Sub-Saharan Africa	67.7	72.2	81.4	89.3	93.8
East Asia and the Pacific (Richer)	97.7	100.0	100.0	100.0	100.0
North America and Western Europe	95.2	99.9	100.0	100.0	100.0
World	86.6	91.3	95.1	97.3	98.3

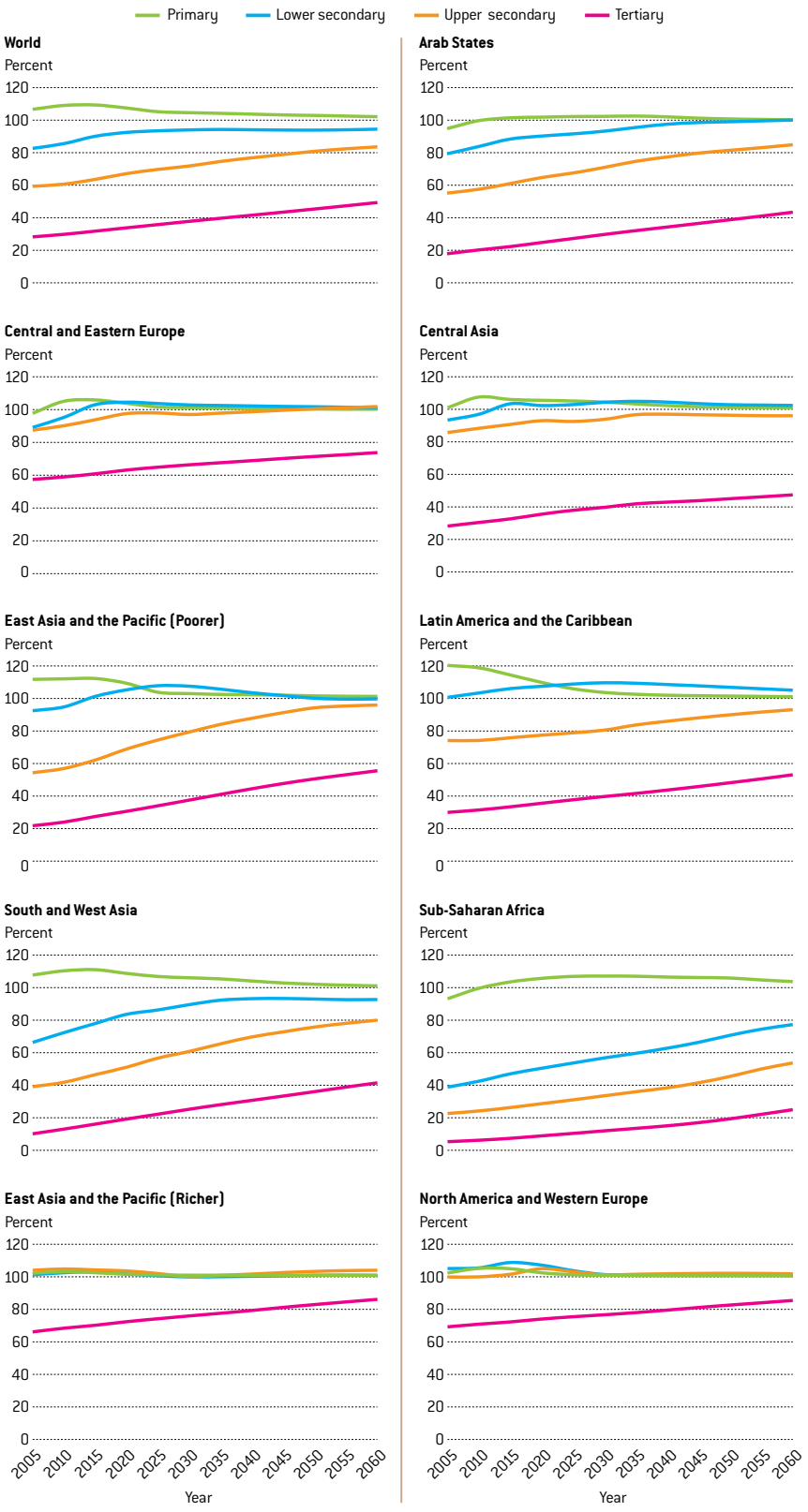
Source: IFs Version 6.12 base case forecast.

4 Michael A. Clemens, "The Long Walk to School: International Educational Goals in Historical Perspective," Working Paper no. 37 (Washington, DC: Center for Global Development, 2004).

5 Clemens, "The Long Walk to School," 15–16.

6 Annababete Wils, Bidemi Carrol, and Karima Barrow, "Educating the World's Children: Patterns of Growth and Inequality," EPDC Working Paper (Washington, DC: Education Policy and Data Center, 2005), 22.

Figure 3 Gross enrollment rates by region and education level: Base case forecast



Source: IFs Version 6.12 base case forecast.

will be approaching 95 percent—a remarkable achievement.

- The developing world will also see continued large gains in both upper secondary and tertiary enrollment rates throughout the period; every region except sub-Saharan Africa is likely to see at least 80 percent upper secondary gross enrollment rates by 2060 and at least 40 percent tertiary enrollment rates.
- Although sub-Saharan Africa will also make large gains in enrollment rates over the period, its enrollment levels in 2060 will remain well below those of all other developing regions, primarily because of its lower enrollment rates at the beginning of the forecast period and the later time at which it will reap its peak benefit from lower fertility rates.

In Table 2, we show forecasts of primary net enrollment rates by region, as net enrollment rates are a better marker of age-appropriate intake and steady progression through the primary grades. If we consider even a 97 percent enrollment rate as "universal," we forecast that most of the developing regions will be short of universal primary education in the 2015 MDG target year, although two—East Asia and the Pacific (Poorer) and Latin America and the Caribbean— will be all but there. In fact, although most countries will have achieved at least a 90 percent primary net enrollment rate by 2015, the IFs base case identifies 37 (not shown) that may not. Further, 27 of those (almost all in sub-Saharan Africa) may not reach 90 percent by 2030, including some whose recent gains have been so rapid that we question whether they can be sustained. And while nearly all countries are likely to reach the 90 percent level by 2060, we forecast that sub-Saharan Africa as a whole will not quite reach UPE even by 2060.

Gender parity in enrollment. Using the typical measure of gender parity in education participation (a ratio of female to male enrollment between .97 and 1.03), parity at the primary level was reached by

2005 in most regions, and at secondary levels by many. However, many countries are still below female parity, and the forecasts of the IFs base case suggest that many will remain below parity in 2015.

Regionally, the lowest gender parity ratios in 2005 were in sub-Saharan Africa—only its primary enrollment rates exceeded a 0.90 female-to-male ratio (the gross enrollment ratio was 0.94 and the net ratio was 0.92), and each higher level of education had a progressively worse ratio. The base case forecasts that sub-Saharan Africa will make continued progress in reducing female disadvantage, with the primary net gender parity ratio reaching 0.97 just before 2030. Even at that time and later, many sub-Saharan African countries (still as many as a dozen in 2040) likely will be short of the goal.

The Arab States and South and West Asia are the two other regions with the greatest female disparities in recent decades. However, our base case suggests female parity will have been substantially reached at primary and both lower and upper secondary levels in the Arab States by 2015 and at the primary level and lower secondary levels in South and West Asia, with some individual country exceptions in both regions. Female parity at the upper secondary level in South and West Asia appears to be unlikely until about 2025.

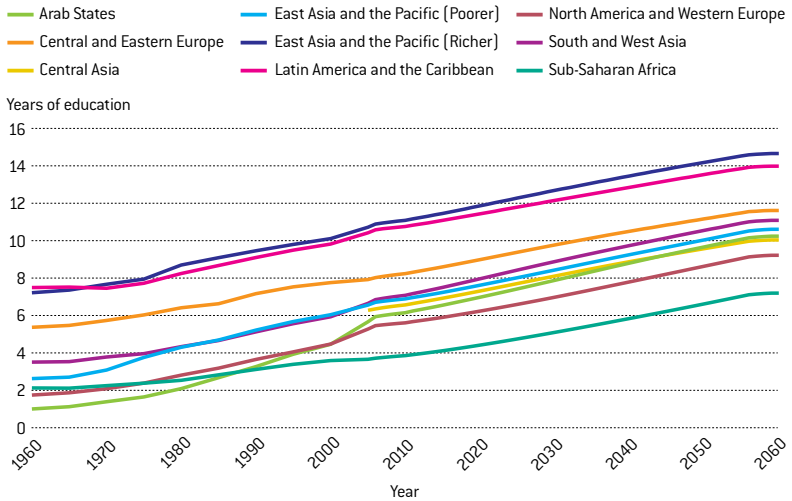
The story is different at the tertiary level. Our forecasts show male gaps increasing around the world, reaching a global average of 1.3 females for each male in 2060. This is in part because female gender gaps at lower levels will continue to decrease and more females, aided by their lower repetition and higher persistence rates, will be eligible over the period to pursue advanced education. However, we consider our tertiary education forecasts to be surrounded by more uncertainty than those at other levels. It may be that females are in a catch-up mode at the tertiary level and that the imbalances will gradually lessen, or that males' higher repetition and lower persistence rates at lower levels may diminish. On the other hand, it may be that females in many parts of the world need—and will continue for some time to need—more education than men in order to compete for similar work.

Education attainment patterns. Although progressions to high levels of enrollment are the foundation of the global education transition, ultimately the goal is for adults to have the capabilities that allow them to live their lives as educated members of society. What might a transition in adults' attainment levels look like?

Figure 4 shows the history of average years of education of adults 15 years and older by region since 1960, extended by our base case forecasts to 2060. A steady pattern of progression is apparent as increased school participation of children and youth translates, over a period of generations, into higher levels of attainment across adult populations. The global average years of education of those 15 years and older in 1960 was 3.8. By 2000 it had increased to 6.3 years, and we forecast a global average of 10.2 years in 2060—a remarkable transition. Average years of education are increasing both in high-income regions and in all developing regions. However, sub-Saharan Africa, despite our forecast of steady gains to 7.3 years in 2060, is not likely to increase its adult attainment levels at the same rate as other developing regions over our forecast horizon because of its later transitions in enrollment rates at secondary and tertiary levels.

We present historical and IFs base case forecasts of changes in average years of education for males and females separately by region and the world in Table 3.[7] By 2010, females have made substantial—and sometimes striking—gains (see especially the Arab States). In all regions, female attainment lagged that of males in 1960 and 2010, often significantly. In our 2060 forecasts, some female lags still exist, but they are fewer and proportionately far smaller; in every region but South and West Asia, female attainment rates are 93

Figure 4 Average years of education of adults 15 years and older: History and base case forecast



Note: Values are 5-year moving averages with 1990 for Central Asia removed for smoothing.

Source: IFs Version 6.12 base case with Barro and Lee (2001) data through 2000.

7 The 1960 regional values are compiled from country-level data in Robert J. Barro and Jong-Wha Lee, "International Data on Educational Attainment: Updates and Implications," *Oxford Economic Papers* 53 (2001): 541–563.

Table 3 Male and female average years of education by region: History and base case forecast

	1960		2010		2060	
	Male	Female	Male	Female	Male	Female
Arab States	1.1	0.4	6.6	5.1	10.8	10.3
Central and Eastern Europe	5.8	4.5	8.5	7.6	12.3	11.4
Central Asia	no data	no data	6.9	6.0	10.9	10.1
East Asia and the Pacific (Poorer)	3.0	1.8	7.5	5.8	11.2	10.5
Latin America and the Caribbean	3.3	3.2	7.1	6.6	11.2	11.2
South and West Asia	2.2	0.7	6.5	4.2	10.4	9.0
Sub-Saharan Africa	2.3	1.5	4.2	3.1	7.8	7.4
East Asia and the Pacific (Richer)	7.8	6.7	11.1	10.1	14.2	13.9
North America and Western Europe	7.1	6.9	11.0	10.8	14.4	14.7
World	4.2	3.3	7.4	5.9	10.6	9.9

Source: IFs Version 6.12 base case with Barro and Lee (2001) data for 1960.

percent or more of male rates (in South and West Asia they have increased from 32 percent of male rates in 1960 to 86 percent in our 2060 forecast; by 2070 they are at 90 percent). And, as we noted earlier, average years will continue to increase dramatically for both sexes throughout the period.

A Normative Scenario to Accelerate Education's Advance

Introduction

Successive global meetings have set education targets that did not reflect the great differences in countries' participation rates and, therefore, the widely varying distances they needed to travel in order to reach the goal in a specific "universal" target year. We argue, however, that setting a common target year for meeting education goals is not a desirable approach. For those countries starting a target period at very low enrollment levels, the required speed of growth in participation rates to meet a very near-term target year often has been untenable, especially in those cases when school-age populations are very large and public resources are highly constrained.

Therefore, we developed a different approach for setting targets. As we did so, we also hoped to identify a global scenario in which advance might occur more rapidly than in our base case. And finally, we did not want to confine our analysis to the primary level because of the inevitable and important connections across levels of education. Accordingly, our approach is based on aggressive but simultaneously realistic attention to leverage points across multiple levels of education.

Our normative scenario rests on two types of leverage points: (1) target rates of annual growth in student flows at primary and secondary levels; and (2) target per-student costs at each level of education. In this section, we first consider student flow targets and the impact they would have on enrollment rates and adults' attainment levels if there were no budgetary constraints to their implementation. After that, we consider per-student spending targets and the incremental resource requirements of the normative scenario, as well as the positive impacts or "forward linkages" of an accelerated advance in education that might justify the incremental expenditures it would require.

Student flow targets

After exploring multiple streams of information (listed below), we established target rates of growth—differentiated by education level—for the following student flow variables: intake and transition, survival,[8] and movement to gender parity (Table 4 summarizes these rates).

Our normative student flow targets were developed iteratively as we reviewed data and applied qualitative judgments to many evidence streams:

- historical experience across levels of education (e.g., we found an accelerated takeoff in lower secondary gross enrollment rates when primary net enrollment exceeds about 80 percent)
- interaction and threshold effects within each level of education (e.g., too rapid growth in intake and transition rates often results in decreasing survival rates as the desire to educate more students overwhelms the ability to do so well)
- review of existing studies (e.g., Clemens, and Wils, Carrol, and Barrow)
- analysis of the intake, survival, and transition rates across primary, lower secondary, and upper secondary levels of the 32 countries with the most complete UIS data between 1999 and 2005 (all 32 are developing countries)
- review of high-growth countries (findings from a study by Bruns, Mingat, and Rakotomalala[9] and also from our own analysis of the 20 countries with the most rapid growth in intake, transition, and survival

8 "Survival" is defined as the percentage of a cohort of students in the first grade of a given level of education who subsequently reach successive grades or levels (see http://www.uis.unesco.org/glossary). Survival rates, rather than completion rates, are widely used as a measure of persistence since completion data (1) are not as available, and (2) have different meanings in different school systems (e.g., completion may mean "simply" progressing through a series of grades, or it may require successfully completing an exit examination).

9 Barbara Bruns, Alain Mingat, and Ramahatra Rakotomalala, *Achieving Universal Primary Education by 2015: A Chance for Every Child* (Washington D.C.: World Bank, 2003).

Table 4 Summary of target student flow rates in IFs normative education scenario			
	Intake/transition	**Survival**	**Gender parity**
Primary	2.2 percentage point annual increase	1.2 percentage point annual increase (2 percentage points could be reasonable for some countries in catch-up mode, especially above 65 percent survival)	1.0 percentage point (0.01) annual closure in parity ratios for both intake and survival
Lower secondary	1.0 percentage point annual increase (has compounding effect on top of primary growth)	0.8 percentage point annual increase	0.8 percentage point (0.008) annual closure in parity ratios for both transition and survival
Upper secondary	0.5 percentage point annual increase (historically, this would ramp up with increased lower secondary enrollment)	0.3 percentage point annual increase (country or regional catch-up specifications could be as much as 2 points, e.g., in South and West Asia)	0.5 percentage point (0.005) annual closure in parity ratios for both transition and survival
Tertiary	Normative scenario does not change this (2 percentage points growth in gross enrollment would be aggressive)	Normative scenario does not change this (2 percentage points growth in gross enrollment would be aggressive)	Normative scenario slowly moves gender ratios to 1.0 (beyond forecast horizon)

Note: Maximum values are at 50 percent intake/transition and 65 percent survival with relative slowing at higher and lower levels, generating an S-shaped curve of growth.

Source: Compiled by the authors.

between 1999 and 2005, as well as the set of countries with especially rapid narrowing of gender gaps over the period from 1980 to 2005)

- analysis of the characteristics of problem countries to understand better the circumstances that can impede the advance of education
- cross-sectional analyses (e.g., analyses of relationships between normative target variables—such as upper secondary enrollment rates as a function of lower secondary enrollment rates—across all reporting countries)
- analysis of enrollment patterns in various regional and country groupings (e.g., analysis of enrollment rates that were able to be sustained after periods in which enrollment grew especially rapidly).

Accelerating education's advance if budget were not a constraint

We first explore the consequences of our normative student flow targets as if there were no budgetary constraints to their implementation; after that we consider their incremental costs and some implications of those costs.

In Figure 5, we see a comparison between the base case and the normative scenario of the time frame within which regions might reach various enrollment levels: 90 and 97 percent or more at the primary level (net); 90 and 97 percent or more at the lower secondary level (gross); 80 percent at the upper secondary level (gross); and a 60 percent gross rate at the tertiary level.

The normative scenario has the biggest impact in sub-Saharan Africa, followed by South and West Asia. Such a future would cut about one generation off the period those regions are otherwise likely to need in order to move beyond UPE to universal basic education and to high participation rates in upper secondary education, as well as accelerate such progressions across much of the rest of the developing world. In terms of adults' education attainment levels, by 2060 the normative scenario adds nearly two years of education to the base case value for sub-Saharan Africa (almost nine years rather than just over seven) and close to one year in South and West Asia, with smaller gains in other regions.

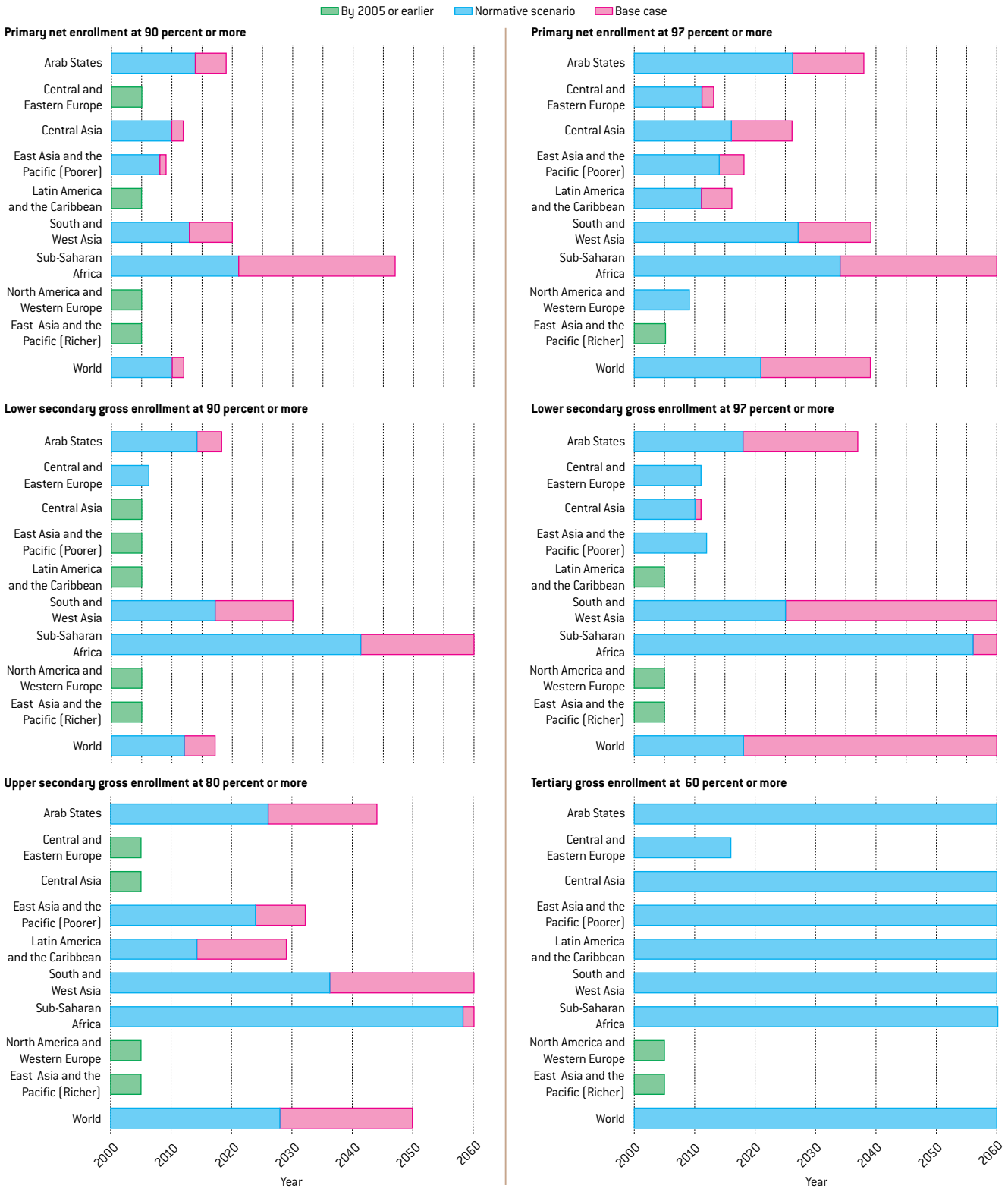
Resource requirements, constraints, and paybacks

The IFs system of models includes forecasts of economic growth, government revenues, and the allocation of government resources across categories of public spending. Constraints arising from our forecasts of these sources limited growth in education participation rates in the base case results presented earlier. In distinction, our presentation of the normative scenario enrollment results in Figure 5 is based on an analysis in which the IFs budget function was temporarily suspended. Clearly, however, given the normative scenario's acceleration of growth in enrollment rates, it would, in fact, have incremental costs.

Our approach to forecasting the incremental costs of the normative scenario was based on establishing target per-student costs at each education level. Our goal was to identify spending levels that are sufficient to provide for quality in education (as other quantitative analyses have done, we used survival rates as a proxy for quality) and also reflective of efficiency.

We first looked at historical per-student cost data available from UIS. We found quite consistent per-student spending patterns when we grouped the data by country income classifications (see Table 5). At the primary and lower secondary levels, low-income and lower-middle-income countries spend considerably less per student as a percentage of GDP per capita than do upper-middle-income and high-income countries. It seems reasonable to speculate that such levels for lower-income countries represent inadequate spending as a result of resource constraints and high child-dependency ratios. In contrast, however, low-income countries as a group spend much more per student at

Figure 5 Years when global regions attain various enrollment rates: Normative scenario relative to base case



Note: Values of 2005 are 2005 or earlier; values of 2060 are 2060 or later; in cases where a benchmark is reached at a future time and only a blue line is shown, both the normative scenario and the base case are forecast to reach the benchmark within a year of each other.

Source: IFs Version 6.12.

the upper secondary and (especially) the tertiary levels than do richer countries. This almost certainly reflects both the great difficulty that the poorest countries have in obtaining educated teachers and faculty, as well as high start-up costs more generally and the absence of economies of scale in the early stages of transition at these more specialized levels.[10]

We took two more steps to complete the target-setting process. We first reviewed previous studies that considered per-student costs in the developing countries most successfully increasing their education participation rates at the primary and secondary levels.[11] Interestingly, the most successful countries were not those with the highest per-student costs (which were considered indicators of inefficiency), but rather those with "reasonable" costs. We supplemented the research of others with cross-sectional analyses of per-student spending at each education level as a function of GDP per capita, with attention to central tendencies in higher-income countries as indicators of reasonable per-students costs relative to GDP per capita.

Following our analyses, we adopted the following as targets for annual per-student spending in our modeling: 14 percent of GDP per capita at the primary level, 20 percent at the lower secondary level, and 28 percent at the upper secondary level. At the tertiary level, where per-student costs decline steeply with increases in income, we set 30 percent of GDP per capita as the per-student spending minimum. We used these target per-student costs in the base case as well as in the normative scenario. In the base case, countries converged very slowly from their actual starting costs to the target costs (over a 50-year period), whereas in the normative scenario they converged rapidly over just a 20-year period.

Table 5 Public spending per student as percent of GDP per capita at PPP by country income level

	Country income level			
Education level	Low	Lower middle	Upper middle	High
Primary	11.2	8.5	15.3	19.8
Lower-secondary	20.1	8.9	15.3	23.5
Upper-secondary	50.1	21.3	16.2	25.9
Tertiary	225.9	64.8	31.4	28.7

Note: Countries are grouped by World Bank country income classifications.

Source: IFs Version 6.12 using UIS data.

The resulting cost structure produces per-student savings when countries are currently spending at higher levels (most often at upper secondary and tertiary levels in developing countries) and in additional per-student costs for countries currently spending below target levels (many low-income countries at the primary and lower secondary levels). In the aggregate, however, the accelerated growth

Table 6 Cumulative incremental education spending and GDP: Normative scenario relative to base case (in billions)

	2030			2060		
	Incremental spending	Incremental GDP	GDP/spending	Incremental spending	Incremental GDP	GDP/spending
Arab States	72	75	1.0	156	865	5.5
Central and Eastern Europe	89	22	0.2	192	184	1.0
Central Asia	26	7	0.3	54	61	1.1
East Asia and the Pacific (Poorer)	206	333	1.6	279	5,150	18.4
Latin America and the Caribbean	378	298	0.8	790	2,844	3.6
South and West Asia	305	499	1.6	1,050	9,106	8.7
Sub-Saharan Africa	80	91	1.1	347	1,860	5.4
North America and Western Europe	206	–32	–0.2	377	–52	–0.1
East Asia and the Pacific (Richer)	216	95	0.4	376	320	0.9
World	1,579	1,389	0.9	3,625	20,367	5.6

Note: Both spending and GDP are in billions in 2000 dollars, discounted by 3 percent per year.

Source: IFs Version 6.12.

10 Despite these general patterns, we found tremendous variability in per-student spending rates, particularly in low-income countries.

11 For the primary level, see especially the seminal study by Bruns, Mingat, and Rakotomalala, *Achieving Universal Primary Education by 2015*. For the secondary level, see Melissa Binder, "The Cost of Providing Universal Secondary Education in Developing Countries" in *Educating All Children: A Global Agenda,* Joel E. Cohen, David E. Bloom, and Martin B. Malin, eds., 455-494 (Cambridge, MA: American Academy of Arts and Sciences, 2006). Also at the secondary level, see Ernesto Cuadra and Juan Manuel Moreno, *Expanding Opportunities and Building Competencies for Young People: A New Agenda for Secondary Education* (Washington, DC: World Bank, 2005).

in enrollment rates across education levels in the normative scenario results in very substantial cumulative incremental net costs over the forecast horizon compared to the base case: globally, $1.6 trillion through 2030, and $3.6 trillion through 2060. We are immediately confronted with two very large questions: (1) why might we want to consider such a large additional investment, and (2) how might such costs be covered?

Consideration of both questions requires that we look at the impacts of education on other aspects of human development—that is, at education's "forward linkages." We know that education has a strong positive relationship with fertility reduction and also with increased income at the individual level. Significant evidence also points to an impact on economic growth through a positive relationship with productivity. All of these relationships are taken into account interactively in our analysis of the normative scenario. For example, in sub-Saharan Africa, the region most impacted by the normative scenario, the population is forecast to be 150 million less in 2060 as a result of accelerated decreases in fertility rates (further facilitating the spread of education by reducing the overall demand for resources); per capita income is forecast to be 14 percent greater than in the base case; and cumulative incremental GDP is $1.9 trillion.

Our forecasts of incremental spending requirements compared to incremental GDP from the normative scenario appear by region in Table 6. By 2060, the cumulative global gains in GDP are 5.6 times greater than the cumulative incremental expenditures.

The difficulty for policymaking is the substantial lag between the incremental expenditures and the greater resources from higher growth. The average additional spending needs for regions range from 0.5 to 1.2 percent of GDP, most often peaking in the middle of the period and then declining. In many cases, these increments would not be overwhelming, especially given the long-term benefits. However, for some countries the incremental costs would clearly be problematic. Table 7 shows the education spending of the World Bank's least-developed country (LDC) set in the base case and the normative scenario. Many of the LDCs could direct very little additional GDP to education, so the gap is a very crude estimate of demand for funds in the normative scenario that could not be met from domestic resources.

Table 7 Education spending in the Least Developed Countries: Normative scenario relative to base case

	Education spending (billion 2000 dollars)			
Year	Base case	Normative scenario	Absolute gap	Percent of GDP gap
2005	8.1	8.1	0.0	0.0
2010	10.8	12.5	1.7	0.5
2015	14.4	18.9	4.5	1.0
2020	19.6	28.0	8.4	1.3
2025	27.1	40.5	13.4	1.6
2030	37.3	56.0	18.7	1.6
2035	50.7	75.1	24.4	1.5
2040	68.5	98.8	30.3	1.3
2045	93.7	132.2	38.5	1.1
2050	131.6	184.6	53.0	1.0
2055	188.5	261.9	73.4	0.9
2060	265.3	366.5	101.2	0.8

Source: IFs Version 6.12.

Future Directions and Challenges

This executive summary and the volume on which it is based document a remarkable transition underway in global participation in education and in education attainment. Even in our base case, that transition is forecast to continue at quite rapid rates. In our normative scenario, the rates of transition are significantly accelerated for developing regions, and especially for sub-Saharan Africa. As we move into the next stages of the transition, on what especially should we be focusing our attention?

In the near future, as the world approaches UPE, attention can, will, and should focus on postprimary levels. In all likelihood, universal basic education will become the next global goal, while policy debate over desirable participation patterns is likely to focus on the upper secondary level (recent UIS data indicate 72 percent of countries already have a compulsory lower secondary requirement, even if enrollment rates in many of those countries are not yet near universality, whereas just 12 percent have a compulsory requirement at the upper secondary level). As more and more students complete the primary and lower secondary levels, pressure on the upper secondary level will increase, and countries need to be ready with reasonable policies and options, including, but also extending beyond, traditional formal education. We expect that debates about the desirable extent and forms of postsecondary education also will occur.

Significant challenges to the education transition need to be addressed if it is to meet its potential contributions to human well-being. Countries typically have difficulty achieving the final step from 90 percent to universal enrollment, particularly when there are children who are especially hard to reach or who are socially excluded due to remote location, extreme poverty, physical or mental handicaps, or ethnic and religious divisions. A second challenge is that of sustained funding; despite the widespread "boost" from proportionately fewer children and youth relative to working-age adults, increased participation rates will continue to put financial pressure on many developing countries. And pressure will come not only because of higher enrollment rates, but also because countries will need to pay attention to associated aspects of other systems, such as developing employment opportunities for an educated populace. Finally, investment of effort and resources in education quality is essential if the education transition is to realize its potential for individuals and societies alike.

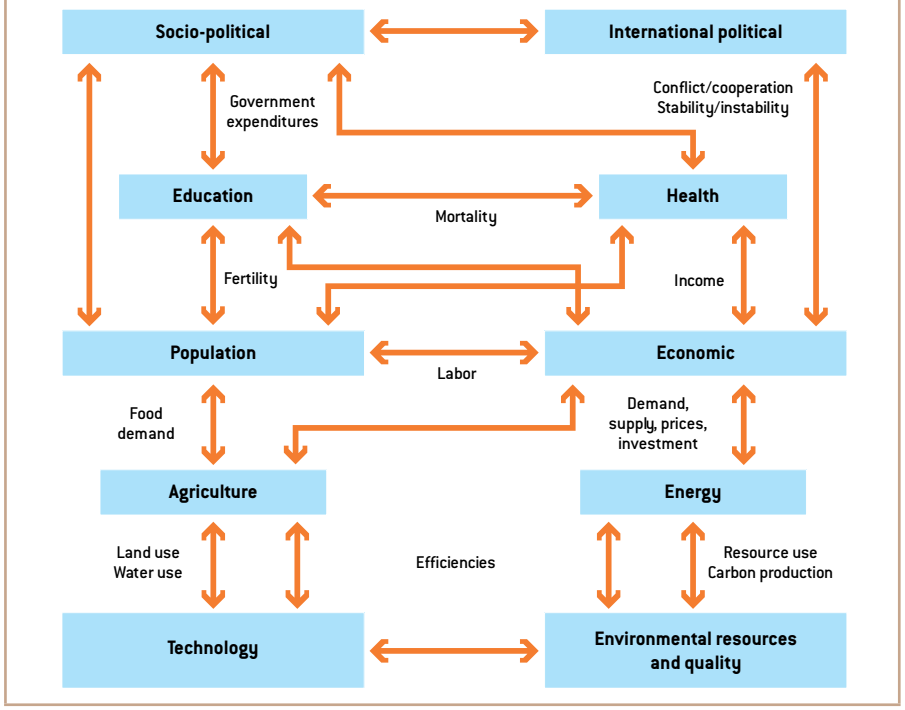
The International Futures (IFs) Forecasting System

The System of Models

IFs is a software tool whose central purpose is to facilitate exploration of possible global futures through the creation and analysis of alternative scenarios. It is large-scale and long-term, and incorporates and integrates models of population, economics, energy, food and agriculture, aspects of the environment, and socio-political change. In support of the **Patterns of Potential Human Progress** series, we have added models of education and health; an infrastructure model is currently being developed and added. Figure 6 shows the major conceptual blocks in the system, and the named linkages between blocks are a small illustrative subset of the dynamic connections between the components.

IFs represents the dynamic connections among all these systems for 183 interacting countries, drawing on standard approaches to modeling specific issue areas whenever possible, extending those as necessary, and integrating them across issue areas.[12] IFs incorporates country-specific data across the issue areas from the family of United Nations member organizations and other sources for as much of the period since 1960 for which various data are available.

Figure 6 Major models in the IFs modeling system and example connections



The IFs Education Model

The IFs education model represents *flows* of education participation and *stocks* of education attainment for females and males separately. The flows are intake, survival, and transition rates across education levels, and the stocks are years of completed education by age category.

Our approach is based on structural representation and causal analysis, as opposed to relying primarily on extrapolation. In the IFs base case, the stocks and flows interact with other systems in IFs (primarily the population and economic models) to create education demand, mediated by the availability of funding for education (generated by the government budget process in the IFs socio-political model), to create education supply. We conceptualize this as a demand-driven, supply-constrained system. On the other hand, in a normative scenario we temporarily lift budgetary constraints in order to explore the systemic results of acceleration in education flow rates; then, as described earlier, the incremental costs of the accelerated transition are calculated and considered, in part against the backdrop of improved human development outcomes associated with the normative scenario.

Table 8 summarizes the most important aspects of the accounting system, the dominant relationships, and the key dynamics that our education model represents.

Interested readers can learn more about the model's methodology from the IFs Help System and from Irfan 2008 (both available at http://www.ifs.du.edu). We mention here only a small number of its more important characteristics.

- IFs accounts for education participation by simulating gender-specific grade-by-grade student flows, using country-specific entry ages and years of schooling at each level to represent enrollments and to distinguish gross and net flow indicators.
- We use analyses of good practice, cross-sectional patterns, and country-specific starting points (slowly modified through gradual convergence to "typical" paths over long time frames) to forecast per-student spending at each level of education.
- Algorithmic structures supplement independent equations and formulations

12 For example, the population model in IFs is based on a typical "cohort-component" representation, tracking country-specific populations and events (including births, deaths, and migration) over time by age and sex; IFs then extends this representation by adding education and health.

Table 8 Foundational elements of the IFs education model	
Education model aspect	**Key elements**
Accounting system	Flows of students into, through, and out of schools Flows of public spending into education system Stocks of adults with different levels of education attainment
Dominant relationships	Intake demand is driven by household income and nonincome systemic factors and follows an S-shaped pattern toward a saturation point Survival rate is driven by the same factors as intake with income being the most dominant Education cost is driven by per capita income with a different cost function at each level of education
Key dynamics	Demographic change Economic development Public education spending constrained by revenue receipts, government consumption, and demands from other public sectors Equilibration between the demand and supply of education funds

in order to protect and represent patterns of relationships across variables; one manages student progression through the grades, another balances funding demand and funding availability in order to shape enrollment and spending levels, and a third determines the flow of graduates into and through the adult population.

Clearly our model has limitations and areas that warrant further development. One is that we use simplifying assumptions in our calculations of grade-to-grade flow rates by netting the effects of drop-out, repetition, and reentry into an average cohort-specific flow rate. Another is in our representation of the tertiary level, where we assume (as does UIS in its treatment of some data) a five-year period for all programs, rather than separately representing the vastly different types and lengths of postsecondary programs. Of greater importance, however, is that by its nature our model can deal only indirectly (e.g., through survival rates) with education quality.

Despite these limitations, we believe our education model has advanced the exploration of the education transition in a variety of important ways.

- It is the first global education model we know of to represent all levels of formal education (including the separation of lower and upper secondary levels) and their interaction effects in grade-by-grade student flows or cohorts.
- By disaggregating enrollment into the components of intake, survival, and transition, it enables analysis of specific leverage points and the relationships among them.
- Our causal approach allows model users to create alternate scenarios based on differing assumptions about driving variables (e.g., fertility rates, economic growth rates, or per-student costs), which may be linked to potential policy levers.
- By virtue of being embedded in a broader system of models, IFs makes possible a reality check in comparison with forecasts that rely on extrapolations solely from enrollment rates over very recent time periods. Importantly, our more dynamic analysis calls into question the likelihood of prolonged periods of extremely aggressive rates of growth.
- The model is freely available for others to use and to develop further.

Undoubtedly the global community will continue to set goals for education. We hope our work will be helpful in those efforts in two particular ways: (1) by suggesting an approach based on aggressive but realistic target rates of change rather than a single fixed target date for all countries; and (2) by providing a tool for interactive analysis of alternative educational futures.

Author Notes

- **Janet R. Dickson** is a Research Associate at the Frederick S. Pardee Center for International Futures at the Joseph Korbel School of International Studies, University of Denver. She has focused for many years on education research, analysis, and planning in a university setting.
- **Barry B. Hughes** is Johns Evans Professor at the Joseph Korbel School of International Studies and Director of the Frederick S. Pardee Center for International Futures, University of Denver. He initiated and leads the development of the International Futures (IFs) forecasting system.
- **Mohammod T. Irfan** is a Research Associate at the Frederick S. Pardee Center for International Futures at the Josef Korbel School of International Studies, University of Denver. His research focus is on long-term computer simulation of education systems around the world.

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