# Achieving Universal Basic and Secondary Education:

## How Much Will It Cost?

*Paul Glewwe, Meng Zhao, and Melissa Binder*

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Please direct inquiries to:
American Academy of Arts and Sciences
136 Irving Street
Cambridge, MA 02138-1996
Telephone: (617) 576-5000
Fax: (617) 576-5050
Email: aaas@amacad.org
Visit our website at www.amacad.org

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# Preface

What would it cost to provide every child in the world with a high quality primary and secondary education? As part of the American Academy's Universal Basic and Secondary Education (UBASE) Project, we asked this question of economists Melissa Binder, Paul Glewwe, and Meng Zhao.

Glewwe and Zhao review World Bank, UNICEF, and UNESCO estimates of the annual costs of achieving universal primary enrollment by 2015. These range from an additional $6.5 billion to $35 billion per year, over and above the approximately $82 billion that developing countries currently spend each year on primary education. These estimates focus on the cost of increasing the number of places for students in schools and the number of teachers to teach them.

However, Glewwe and Zhao also make the vital observation that the number of places available is not always the limiting factor in school attendance rates. As they note, parents choose not to send their children to school for various reasons. The true cost of universal enrollment at the primary level will include the cost of implementing policies that influence those decisions and boost the demand for primary education. Future estimates should account for the cost of providing other improvements necessary to encourage students to attend school—possibly including meals, tuition subsidies to families, higher-quality and more reliable teaching. These costs are far more difficult to calculate. Glewwe and Zhao demonstrate that including some of them boosts the total costs substantially.

The cost of achieving universal secondary education will be greater than that for primary education because more children in this age bracket are not now in school and because secondary education is more expensive per pupil. Melissa Binder offers a pioneering estimate of the cost of achieving universal secondary enrollment. According to her analysis, if a gradual approach is taken between now and 2015, the annual additional cost would be approximately $34 billion. This cost could fall to $32 billion dollars per year if countries were able to reduce repetition rates significantly. The best (albeit unlikely) scenario, in which policymakers adopt the practices of countries most successful in making schooling available to students, getting students to attend school, and helping them learn while they are in school would reduce the additional annual cost of a gradual expansion of secondary education to $27 billion. Binder notes that the biggest expansion of secondary education

will be needed in the poorest countries, where the average per-student yearly cost is lower than in countries that are less poor.

Drafts of each paper were reviewed and discussed by experts at a daylong workshop held in May 2004 at the American Academy in Cambridge, Massachusetts. In addition to ourselves, workshop participants included: Leslie Berlowitz (American Academy), Melissa Binder (University of New Mexico), Barbara Bruns (World Bank), David Canning (Harvard University), Kai-Ming Cheng (University of Hong Kong), James DiFrancesca (American Academy), Paul Glewwe (University of Minnesota), George Ingram (Academy for Educational Development), Dean Jamison (National Institutes of Health), Emmanuel Jimenez (World Bank), Maureen Lewis (Center for Global Development), Marlaine Lockheed (World Bank), Alain Mingat (World Bank), Francois Orivel (Université de Bourgogne), and Kin Bing Wu (World Bank). We thank the participants and six additional anonymous reviewers for their extremely valuable comments. A special thanks is due to Helen Curry at the American Academy, whose intellectual contribution, copy-editing, and project coordination have been indispensable. Leslie Berlowitz's vision and leadership as chief executive officer of the American Academy made this project possible.

The UBASE project focuses on the rationale, the means, and the consequences of providing the equivalent of a primary and secondary education of quality to all the world's children. This monograph is one in a series of the UBASE project published by the American Academy. Other papers examine related topics, including:

- basic facts about education, and the nature and quality of the data that underpin these facts;
- the history of efforts to achieve universal education, and political obstacles that these efforts have encountered;
- the goals of primary and secondary education in different settings, and how progress toward those goals is assessed;
- means of implementing universal education, and the evaluation of these means;
- health and education; and
- economic and social consequences of global educational expansion.

The complexity of achieving universal basic and secondary education extends beyond the bounds of any single discipline and necessitates disciplinary rigor as well as interdisciplinary, international, and cross-professional collaboration. By focusing on both primary and secondary education, paying attention to access, quality, and cultural diversity, and encouraging fresh per-

spectives, we hope that the UBASE project will accelerate and enrich educational development.

This project is supported by major funding from the William and Flora Hewlett Foundation, and by generous grants from John Reed, the Golden Family Foundation, Paul Zuckerman, an anonymous donor, and the American Academy of Arts and Sciences. The project also benefits from the advice of a distinguished advisory committee, whose names are at the back of the volume.

As with all Occasional Papers of the American Academy, responsibility for the views presented here rests with the authors.

Joel E. Cohen
*Rockefeller and Columbia Universities*

David E. Bloom
*Harvard University*

Martin Malin
*American Academy of Arts and Sciences*

CHAPTER 1

# Attaining Universal Primary Schooling by 2015: An Evaluation of Cost Estimates

PAUL GLEWWE AND MENG ZHAO

One of the Millennium Development Goals adopted by the United Nations in 2000 is that every child complete primary school by 2015. This paper examines several recent studies that attempt to calculate the cost of meeting this goal. It argues that most existing studies implicitly assume that the main barrier to attaining this goal is lack of schools and teachers, which is why their cost estimates focus on building more schools and hiring more teachers. Yet there is ample evidence that the main problem is that many parents in developing countries choose not to send their children to the schools currently available. If parents' choice is the main problem, then the existing cost estimates are for the most part irrelevant. Unfortunately, little is known about what can be done to induce parents of non-enrolled children to send their children to school. The paper summarizes the evidence, some of which implies that existing cost estimates are far too low, and suggests the research needed to obtain better estimates.

On September 5, 2000, at the United Nations Headquarters in New York City, 189 countries endorsed eight Millennium Development Goals (MDGs) to improve the quality of life in developing countries by the year 2015. The second of these eight goals is to achieve "universal primary education," ensuring that every child finishes primary school. Although the MDGs set clear targets, they do not explain how to attain these targets.

The intention to attain universal primary education (here referred to as universal primary completion, or UPC), leads to two questions. First, what policy changes can bring about UPC in developing countries? Second, how much additional money will be needed to implement those policies? Several estimates that purport to answer the second question have been published since 2000, but to our knowledge there has been no systematic effort to answer the first. The recent estimates that have been made to answer the second question are based on implicit assumptions about the policies needed to attain UPC. Clearly, the validity of those estimates depends on the accuracy of the implicit policy assumptions.

This paper examines the state of primary education in developing countries and reviews recent estimates of the cost of attaining UPC. These recent studies are best thought of as estimates of the resources that would be needed if: 1) some policy were implemented that persuaded all parents to enroll their children in primary school, and 2) the decision were made to maintain a particular pupil-teacher ratio (often the existing ratio). In general, these studies assume that the primary barrier to enrollment is lack of a nearby school, or lack of room for new pupils to be admitted at a nearby school. However, there is ample evidence from developing countries that a lack of schools is not the main barrier to enrollment.

Basic data on primary school enrollment in developing countries are presented below, including projections for the year 2015. Data are also presented on current government expenditures on education. The paper then reviews, and critiques, four recent attempts to calculate the cost of attaining UPC by 2015. It presents some evidence on policies that can boost primary school enrollment in developing countries and what their likely cost would be, although a significant amount of research remains to be done.

## UNIVERSAL PRIMARY COMPLETION: PROGRESS TO DATE AND PROSPECTS FOR 2015

This paper considers as developing countries all countries that the World Bank (2002) has classified as either low-income or middle-income countries in the year 2000. The list of 151 countries is given in the Appendix. Of these, 66 are classified as low-income countries. Low-income countries are defined as those with an annual income per capita in 2000 (in U.S. dollars) of less than $755. The other 85 are classified as middle-income countries, which have annual per capita incomes in 2000 between $755 and $9265. Table 1 shows the distribution of these countries by geographic region and income level. About 2.5 billion people live in low-income countries and about 2.7 billion people live in middle-income countries. About one half of the population of low-income countries (1.3 billion) are found in South Asia, which primarily reflects India's 1 billion people, and about one fourth (0.6 billion) live in Sub-Saharan Africa. Within middle-income countries, a little more than one half (1.5 billion) live in East Asia, which primarily reflects China's 1.3 billion people, and most of the remainder are found in Latin America and the Caribbean (0.5 billion) or in the Middle East and North Africa (0.35 billion).

For the purposes of this paper, it is useful to classify developing countries according to their progress in attaining universal primary school completion (defined as a primary school completion rate of 95 percent or higher) in the year 2000 (see Table 2). A recent report by the World Bank (Bruns et al., 2003) classified three low-income countries (Azerbaijan, Vietnam, and Zimbabwe) and 33 middle-income countries as having attained UPC by or before the year 2000. These countries constitute about 4 percent of the population of low-income countries and about 71 percent of the population of

**Table 1:** Distribution of Developing Countries by Income Level and Region

| | Low Income | | Middle Income | |
|---|---|---|---|---|
| Region | Number of Countries | Population (millions) | Number of Countries | Population (millions) |
| Sub-Sahara Africa | 39 | 608 | 8 | 50 |
| East Asia and Pacific | 9 | 380 | 13 | 1469 |
| South Asia | 6 | 1338 | 2 | 19 |
| Europe and Central Asia | 9 | 111 | 17 | 297 |
| Latin America and Caribbean | 2 | 13 | 29 | 498 |
| Middle East and North Africa | 1 | 18 | 16 | 345 |
| Total | 66 | 2468 | 85 | 2678 |

Source: Data from World Bank (2002).

Note: Population data are for the year 2000.

middle-income countries (the latter figure largely reflecting China's success in primary education). Another ten low-income countries and twenty middle-income countries are "on track" to achieve UPC by 2015, the target date for the MDGs. "On track" means that a continuation of linear trends from 1990 to 2000 in each of these countries will result in a completion rate of 95 percent or higher by 2015. These countries constitute about 10 percent of the population of low-income countries and about 17 percent of the population of middle-income countries. Thus, only about 14 percent of the population in low-income countries are residents of countries that will attain the goal of UPC by 2015, while about 88 percent of the population in middle-income countries live in countries that will attain this goal.

The remaining countries are either not expected to attain UPC or, for a small number of countries, data to assess their progress are missing. The "off track" countries can be divided into two types. The primary completion rates of "moderately off track" countries are projected to be greater than 50 percent (but less than 95 percent) by 2015, while the primary completion rates of "seriously off track" countries are projected to be 50 percent or lower. In low-income countries, 67 percent of the population live in countries that are "moderately off track" in attaining the goal of UPC, 14 percent live in countries that are "seriously off track," and 5 percent live in countries without reliable data on completion rates. In middle-income countries, 10 percent of the population lives in countries that are off track for attaining UPC by 2015, 1 percent live in countries that are seriously off track and 1 percent live in countries for which no reliable data are available on completion rates.

The figures in Table 2 may give the impression of a crisis regarding the achievement of UPC in low-income developing countries. 80 percent of the population in those countries are residents of countries that are off-track or seriously off-track. However, in most of these countries, a majority of children will complete primary school. Table 3 shows primary school completion rates for 2000 and projected primary school completion rates for 2015 in low-

**Table 2**: Distribution of Developing Countries by Income Level and Progress in Attaining Universal Primary Completion

| | Low Income | | Middle Income | |
|---|---|---|---|---|
| **Progress Status** | **Number of Countries** | **Population (millions)** | **Number of Countries** | **Population (millions)** |
| Already Attained | 3 | 99 | 33 | 1898 |
| On Track to Attain by 2015 | 10 | 246 | 20 | 467 |
| Off Track to Attain by 2015 | 24 | 1663 | 19 | 265 |
| Seriously Off Track | 22 | 340 | 2 | 24 |
| Missing Data | 7 | 117 | 11 | 36 |
| Total | 66 | 2468 | 85 | 2678 |

Sources: Data from World Bank (2002) and Bruns et al. (2003).

Note: Population data are for the year 2000.

and middle-income countries, categorized as they are in Table 2. In 2000, 73 percent of children in "off track" low-income countries completed primary school, and this number is projected to increase to 84 percent by 2015. Only in the countries that are "seriously off track" (a group that is smaller in terms of population size) is the situation bleaker. These countries had a primary completion rate of 35 percent in 2000, a rate that is projected to drop to 25 percent by 2015. In all low-income countries, the overall primary school completion rate is estimated to have been 68 percent in 2000 and is expected to increase to 77 percent in 2015 (if trends from 1990 to 2000 continue). In middle-income countries the completion rate was already 97 percent, and it is projected to hold steady (96 percent).

Little can be done to assess the situation in countries with missing data. Seven low-income countries lack reliable data on primary completion rates: Kyrgystan, Liberia, Myanmar, North Korea, Somalia, Turkmenistan, and Uzbekistan. Among middle-income countries, data are missing for eleven. Of these, six are small island nations: Kiribati, the Marshall Islands, Micronesia, Palau, Seychelles, and Tonga. The other five are Kazakhstan, Libya, Macedonia, Palestine, and Suriname. The seven low-income countries with missing data constitute 4.7 percent of the population of all low-income countries and the eleven middle-income countries constitute 1.0 percent of the population of all middle-income countries. Thus the omission of these countries will have only a small effect on the results of this study.

This study also excludes the formerly socialist countries of Eastern Europe and Central Asia, for three reasons. First, data are scarce for these countries (Table 4), especially historical data that allow one to determine whether these countries will attain UPC by the year 2015 (this limitation applies to 12.7 percent of the population). Second, the history of these countries is very different from that of the other low- and middle-income countries. Third, most of them have either already attained UPC or are on track to do so. Those that are not (Albania, Armenia, Belarus, Estonia, Georgia, and

**Table 3**: Primary School Completion Rates by Income Level and Progress in Attaining Universal Primary Completion

| | Low Income | | Middle Income | |
|---|---|---|---|---|
| **Progress Status** | **2000** | **Projection for 2015** | **2000** | **Projection for 2015** |
| Already Attained | 103 | 100 | 105 | 99 |
| On Track to Attain by 2015 | 71 | 98 | 82 | 100 |
| Off Track to Attain by 2015 | 73 | 84 | 82 | 79 |
| Seriously Off Track | 35 | 25 | 57 | 34 |
| Missing Data | — | — | — | — |
| Total | 68 | 77 | 97 | 96 |

Sources: Data from World Bank (2002) and Bruns et al. (2003).

Note: Total average primary completion rates (PCR) are weighted by primary-school-aged population. The World Bank defines the PCR as "the number of students successfully completing the last year of (or graduating from) primary school in a given year, divided by the number of children of official graduation age in the population" (Bruns et al., 2003). Where the PCR is greater than 100, this indicates that a significant number of students completing the last year of primary school are from age groups that are not the official graduation age.

Tajikistan) constitute only 7 percent of the primary school age population of these countries (another 13 percent live in countries with missing data, but that lack of data also precludes their use in this study). One country in this group, Turkey, is not a former socialist state. For simplicity, this paper retains Turkey but assigns it to the category Middle East/North Africa. This reclassification has minimal effect. As Turkey is on target to attain UPC by 2015, it is not used in any of the calculations in this paper on the cost of attaining UPC by 2015.

Before turning to cost, a few comments should be made about region-specific trends in UPC (Table 4). The most worrisome region is Sub-Saharan Africa. Nearly 90 percent of the population of this region live in countries that are off track to attain UPC by 2015, and nearly half of the population are in countries that are seriously off track. For Sub-Saharan African countries as a group, the primary school completion rate was only 53 percent in 2000. The World Bank projections indicate that it will remain at 53 percent in 2015.

The situation in East Asia is much better. Only about 15 percent of the population live in countries that are off track, and none of the countries (with the possible exception of the few with missing data) is seriously off track. In contrast, almost 90 percent of the population of South Asia live in countries that are off track, which mostly reflects India's weak performance. Yet, unlike Sub-Saharan Africa, only a tiny percent of the population (2–3 percent) live in countries that are seriously off track. For South Asia as a whole, the primary school completion rate in 2000 was 72 percent. The World Bank projection for 2015 is 87 percent.

In Latin America and the Caribbean, the situation is much more hopeful. About 95 percent of the population live in countries that have already

**Table 4**: Progress in Attaining Universal Primary Completion, by Region

| | Low Income | | Middle Income | |
|---|---|---|---|---|
| | Number of Countries | Population (millions) | Number of Countries | Population (millions) |
| **Sub-Saharan Africa** | | | | |
| Already Attained | 1 | 13 | 4 | 46 |
| On Track to Attain by 2015 | 4 | 38 | 3 | 4 |
| Off Track to Attain by 2015 | 11 | 231 | – | – |
| Seriously Off Track | 21 | 314 | – | – |
| Missing Data | 2 | 12 | 1 | 0.1 |
| Total | 39 | 608 | 8 | 50 |
| **East Asia and Pacific** | | | | |
| Already Attained | 1 | 79 | 4 | 1312 |
| On Track to Attain by 2015 | 2 | 17 | 1 | 77 |
| Off Track to Attain by 2015 | 4 | 214 | 3 | 84 |
| Seriously Off Track | – | – | – | – |
| Missing Data | 2 | 70 | 5 | 0.4 |
| Total | 9 | 380 | 13 | 1469 |
| **South Asia** | | | | |
| Already Attained | – | – | 2 | 19 |
| On Track to Attain by 2015 | 1 | 131 | – | – |
| Off Track to Attain by 2015 | 4 | 1176 | – | – |
| Seriously Off Track | 1 | 27 | – | – |
| Missing Data | – | – | – | – |
| Total | 6 | 1338 | 2 | 19 |
| **Europe and Central Asia** | | | | |
| Already Attained | 1 | 8 | 9 | 251 |
| On Track to Attain by 2015 | 2 | 54 | 3 | 15 |
| Off Track to Attain by 2015 | 3 | 15 | 3 | 15 |
| Seriously Off Track | – | – | – | – |
| Missing Data | 3 | 35 | 2 | 17 |
| Total | 9 | 111 | 17 | 297 |
| **Latin America and the Caribbean** | | | | |
| Already Attained | – | – | 12 | 204 |
| On Track to Attain by 2015 | 1 | 5 | 8 | 242 |
| Off Track to Attain by 2015 | 1 | 8 | 8 | 53 |
| Seriously Off Track | – | – | – | – |
| Missing Data | – | – | 1 | 0.4 |
| Total | 2 | 13 | 29 | 498 |
| **Middle East and North Africa** | | | | |
| Already Attained | – | – | 2 | 69 |
| On Track to Attain by 2015 | – | – | 5 | 131 |
| Off Track to Attain by 2015 | 1 | 18 | 5 | 114 |
| Seriously Off Track | – | – | 2 | 24 |
| Missing Data | – | – | 2 | 8 |
| Total | 1 | 18 | 16 | 345 |

Sources: Data from World Bank (2002) and Bruns et al. (2003).

Note: Population data are for the year 2000.

achieved UPC, or will achieve it by 2015, and none of the few off-track countries is seriously off track. For the region as a whole, the primary school completion rate in 2000 was 83 percent, and the projected rate for 2015 is 95 percent. The countries of North Africa and the Middle East are between these extremes. About 55 percent of the population live in countries that have already achieved UPC, or will achieve it by 2015. About 35 percent live in countries that are off track, but not seriously off track, and only about 7 percent live in countries that are seriously off track (2–3 percent are in countries with missing data). For the region as a whole, the primary school completion rate in 2000 was 85 percent, and the projected rate for 2015 is 87 percent.

## CURRENT COSTS OF PRIMARY EDUCATION

This section presents data from developing countries on current government expenditures on primary education, including both recurrent costs and capital costs. Because detailed data on household expenditures on education are unavailable for many countries, and because proposed programs to achieve UPC inevitably will be financed by governments, only government expenditures are documented here. The section then focuses on countries for which UPC is unlikely to be attained by 2015, presenting data that divide total costs into teacher costs and other costs.

### *Total Current Cost*

Data on current costs (presented in Table 5) are available for almost all developing countries. This subsection presents those data by region, income level, and on-track versus off-track status.

In the year 2000, Sub-Saharan African countries spent a total of $6.1 billion on 89 million students in primary school, or $68 per pupil per year on average. This average is inflated by five countries (Botswana, Cape Verde, Mauritius, South Africa, and Zimbabwe) that have already attained UPC and spend, on average, $376 per student per year, and one country, Seychelles, for which data are missing on enrollment but spending per pupil is known to be $650 per student per year. Excluding these countries leaves per student spending rates of $35 for countries that are on track to achieve UPC, $27 for students that are off track, and $31 for countries that are seriously off track. Thus Sub-Saharan countries not only have a substantial number of students who are not finishing primary schooling (39 million), but those who are enrolled attend schools with very low spending per pupil, which suggests low quality education.

The developing region with the lowest spending per primary school pupil is South Asia. Although governments in that region spend slightly more than governments in Sub-Saharan Africa, $6.9 billion, the number of pupils enrolled is much higher, at 149 million. Government spending per pupil in this region is only $46 per year. The two countries that have already attained UPC, the Maldives and Sri Lanka, spend, on average, $80 per pupil, while the one country that is on track to attain UPC by 2015, Bangladesh, spends only

**Table 5**: Current Per Year Expenditures on Primary Schooling in Developing Countries

| Region | Percent of Population | | Spending per Student (US $) | Total Spending (millions US $) | Percent of population with spending data |
|---|---|---|---|---|---|
| | Within Region | All Developing Countries (except Europe & Central Asia) | | | |
| **Sub-Saharan Africa** | | | | | |
| Already Attained | 9 | 1 | 376 | 3720 | 94 |
| On Track to Attain | 6 | 1 | 35 | 388 | 100 |
| Off Track | 35 | 5 | 27 | 820 | 100 |
| Seriously Off Track | 48 | 7 | 31 | 1160 | 84 |
| No Enrollment Data | 2 | 0 | 650 | 7 | 1 |
| Total | 100 | 14 | 68 | 6100 | 98 |
| **East Asia and Pacific** | | | | | |
| Already Attained | 75 | 29 | 99 | 15,000 | 100 |
| On Track to Attain | 5 | 2 | 101 | 1620 | 100 |
| Off Track | 16 | 6 | 118 | 4580 | 100 |
| Seriously Off Track | – | – | – | – | – |
| No Enrollment Data | 4 | 1 | 227 | 18 | 0 |
| Total | 100 | 38 | 103 | 21,200 | 96 |
| **South Asia** | | | | | |
| Already Attained | 1 | 0 | 80 | 144 | 99 |
| On Track to Attain | 10 | 3 | 25 | 449 | 100 |
| Off Track | 87 | 25 | 49 | 6320 | 100 |
| Seriously Off Track | – | – | – | – | – |
| No Enrollment Data | – | – | – | – | – |
| Total | 100 | 28 | 46 | 6910 | 98 |
| **Europe and Central Asia** | | | | | |
| Already Attained | 63 | – | 1048 | 4860 | 25 |
| On Track to Attain | 17 | – | 264 | 195 | 22 |
| Off Track | 7 | – | 268 | 147 | 34 |
| Seriously Off Track | – | – | – | – | – |
| No Enrollment Data | 13 | – | – | – | – |
| Total | 100 | – | 878 | 5210 | 22 |
| **Latin America and the Caribbean** | | | | | |
| Already Attained | 40 | 4 | 608 | 17,200 | 95 |
| On Track to Attain | 48 | 5 | 339 | 10,500 | 98 |
| Off Track | 12 | 1 | 97 | 466 | 46 |
| Seriously Off Track | – | – | – | – | – |
| No Enrollment Data | – | – | – | – | – |
| Total | 100 | 10 | 440 | 28,200 | 90 |
| **Middle East and North Africa** | | | | | |
| Already Attained | 19 | 1 | 226 | 167 | 7 |
| On Track to Attain | 36 | 3 | 972 | 11,400 | 75 |
| Off Track | 36 | 3 | 179 | 2670 | 87 |
| Seriously Off Track | 7 | 1 | 299 | 13 | 3 |
| No Enrollment Data | 2 | 0 | – | – | 0 |
| Total | 100 | 8 | 519 | 14,200 | 60 |
| **Total** | – | 100 | 151 | 81,800 | 88 |

Sources: Data from World Bank (2002) and Bruns et al. (2003). Averages are weighted by number of pupils, taken from Bruns et al. (2003).

$25 per pupil. The remaining countries are all off track. On average they spend $49 per pupil.

East Asia has the largest population of all the regions, with 1.85 billion people. The governments in those countries spend about $21 billion on primary education each year. With 206 million students in primary school, this yields an average of $103 per student per year. This average is very similar across countries, regardless of their UPC status. (One country, Micronesia, has no data on total enrollment but spends $227 per student per year; this country is in the "No Data" category for East Asia in Table 5.) In fact, the countries that have already achieved UPC spend slightly less per pupil per year, $99, while those on track to attain UPC in 2015 spend $101, and those that are off track spend $118. The figure of $99 primarily reflects education spending in China.

The other three regions—Europe and Central Asia, the Middle East and North Africa, and Latin America and the Caribbean—spend much more per student per year: $878, $519, and $440, respectively. As explained above, this paper does not discuss Europe and Central Asia in detail. Turning to Latin America, greater spending per student coupled with 64 million students in primary school implies that about $28 billion is spent per year in that region.[1] Unlike the lack of correlation between spending per pupil and UPC in East Asia, Latin America's progress in attaining UPC is positively correlated with spending per student. In countries that have already attained UPC, the average spending per primary student is $608, while countries on track spend $339 and countries that are off track spend $97.

Countries in the Middle East and North Africa spend about $14 billion on primary school education each year. Divided among 27 million pupils, this is an average expenditure of $519 per pupil per year. There is no clear relationship between UPC progress and spending per pupil in this region. The two countries that have already attained UPC, Egypt and Jordan, spend (on average, which primarily reflects Egypt) $226 per pupil per year. The five countries that are on track to attain UPC by 2015 (Algeria, Oman, Saudi Arabia, Tunisia, and Turkey) spend much more, an average of $972 per pupil. The six countries that are off track (Bahrain, Iran, Lebanon, Morocco, Syria, and Yemen) spend a relatively low amount, $179, but the two countries that are seriously off track, Djibouti and Iraq, spend (on average, which primarily reflects Iraq) almost twice as much, $299.

In sum, the developing countries of the world for which there are data spent about $82 billion on primary education in 2000. This number varied from only $6 billion in Sub-Saharan Africa, which reflects both the low average expenditure of $68 per pupil per year and low enrollment rates, to $28 billion in Latin America and the Caribbean, which reflects near-universal enrollment and an average expenditure of $440 per pupil per year.

1. The spending per student in Latin America is likely to be underestimated because a relatively large percentage of children attend private school. Because separate data on private school students are often unavailable, the figures in Table 5 divide total government spending on education by all students, public and private.

**Table 6**: Teacher and Non-Teacher Costs of Primary Education

| Status | Teacher costs per pupil (US $) | Non-teacher costs per pupil (US $) | Teacher costs as a percent of total costs |
|---|---|---|---|
| Already Attained | – | – | – |
| On Track to Attain | 14.7 | 5.2 | 75 |
| Off Track | 32.0 | 8.4 | 79 |
| Seriously Off Track | 27.5 | 6.8 | 80 |
| All | 29.0 | 7.7 | 79 |

Source: Bruns et al. (2003).

### *Teacher Costs and Non-Teacher Costs*

The discussion thus far has examined total costs to governments of providing primary education. Ideally, one would consider the major components of these costs, such as teacher and administrator salaries, pedagogical materials, and construction and maintenance. Unfortunately, there are few systematic data on the composition of costs. Although individual country studies break the costs down in more detail, very little disaggregated information is comparable across a wide range of countries.

Bruns et al. (2003) report the limited information that is available on the division of total costs into teacher salaries and non-teacher costs (which includes the salaries of non-teacher staff). Table 6 presents per student costs (in U.S. dollars), disaggregated into teacher salary costs and other costs, for low-income countries only.[2] These countries are grouped according to their prospects for attaining UPC. Data are available for only 28 of the 56 low-income countries that have not already achieved UPC (and are not missing any other data).[3] The percent of money spent on teacher salaries varies little. The lowest level is 75 percent, which is in countries that are on track to attain UPC by 2015, and the highest is 80 percent, for countries that are seriously off track. In most educational systems in both developed and developing countries, teacher salaries account for more than half of total costs, so these figures for low-income countries are not very surprising. Without more data and further analysis, it is not possible to say whether these figures strike a good balance between teacher salary costs and other costs.

## REVIEW OF PAST ESTIMATES OF UNIVERSAL PRIMARY ENROLLMENT OR COMPLETION

Three recent studies have attempted to calculate the cost of attaining UPC by 2015. Each is subject to specific criticisms, and a general criticism applies to all three.

2. This excludes the three countries that have achieved UPC, for which no data are available.

3. Data are available for only 9 on-track countries, which are dominated by Bangladesh, and for 19 off-track countries, which are dominated by India.

### *An Earlier World Bank Estimate*

Before the publication of Bruns et al. (2003), the research staff at the World Bank produced estimates of the costs of attaining all eight Millennium Development Goals (Devarajan et al., 2002). Given the relatively short length of the paper and its objective of calculating the costs of all eight goals, the paper used a simple method to calculate the cost of attaining UPC by 2015.

Devarajan et al. calculated the number of additional children that need to be enrolled in school to attain UPC, about 103 million, and multiplied this by one of four estimates of the cost of enrolling a child in school: 1) the average cost over all developing countries (obtained by dividing total recurrent spending on primary education in all these countries by the number of children enrolled); 2) the median cost per primary school pupil, calculated separately for each region; 3) the average cost per student, calculated separately for each country; and 4) a "target" average cost determined separately for each country, defined as 13 percent of GDP per capita. This procedure ignored population growth from 2000 to 2015 and assumed no economic growth.

With these four methods to calculate the per pupil cost, Devarajan et al. estimated the following annual costs to attain UPC for all developing countries: $11.4 billion, $14.9 billion, $10.4 billion, and $27.6 billion, based on methods 1 through 4, respectively. The fourth scenario is more costly mainly because it implies much higher spending per pupil in East Asia and Latin America compared to the current level of spending, and the additional cost includes not only enrolling new children but also increasing the amount spent on children already enrolled. Because these two regions are already doing well in attaining UPC, this scenario seems inappropriate.

Another World Bank paper (Filmer, 2001) presents some simple estimates of the impact of economic growth on school enrollment from 2000 to 2015. It suggests that growth alone will increase enrollment somewhat, and that the cost to finance the remaining gap will be only 70 percent to 80 percent of the range of estimates in Devarajan et al.[4] These estimates do not speculate on how much can be paid by developing countries and how much is needed from donor agencies.

### *A UNICEF Estimate*

Delamonica, Mehrota, and Vandermoortele (2001) calculate the cost of attaining "education for all" (EFA) at the primary level. Their estimates are based on an analysis of net enrollment rates and do not explicitly account for additional costs due to grade repetition (which leads to "overage" children being enrolled in primary school). Their target for achieving EFA is a net enrollment rate of 100 percent. If net enrollment rates were to reach 100 per-

4. Filmer's paper also attempts to estimate (using cross-country data) the response of enrollment rates to government expenditures on primary education, and finds a weak relationship. A rather simplistic simulation based on the this weak relationship gives cost estimates of $131 billion to $369 billion per year, but the paper does not claim that these estimates be taken seriously.

cent and there were no grade repetition, then every child would finish primary school and thus UPC would be attained.[5]

The authors of the UNICEF study make two other simplifying assumptions. First, they assume that per capita income will not change in developing countries between 2000 and 2015. Second, they assume that the cost of providing education to children not in school is the same as the cost of providing education to those currently in school. These assumptions are made for convenience, and the authors state that using more realistic assumptions would greatly complicate the calculations.

Where the study by Devarajan et al. ignored population growth, the UNICEF estimate for the number of new children that must be enrolled in school to attain EFA accounts for both population growth and a gradual increase in the net enrollment rate to 100 percent. The UNICEF study obtained (or in some cases estimated) net enrollment rates for all countries for the year 2000. Estimates of the number of children of primary school age were taken from the United Nations Population Division for every year from 2000 to 2015. The baseline estimate of the number of children in school "under the status quo" for each year from 2000 to 2015 is the 2000 net enrollment rate multiplied by the estimate of the number of children of primary school age for that year. An annual increase in the net enrollment rate is set for each country, starting from the 2000 net rate, such that the net enrollment rate reaches 100 percent by 2015. The incremental increase in the net enrollment rate is then multiplied by the number of children of primary school age in that year to calculate the number of children in school for each year if EFA were to be attained. The difference between the baseline estimate of children in school and the second estimate is the gap in enrollment that needs to be filled in order to attain EFA by 2015. The paper estimates the gap to be about 170 million new students.

The cost per new student is calculated separately for each country by dividing the current total spending on primary education by the current number of children in primary school. The total cost for each country is then calculated by multiplying the average cost per child by the number of children that must be enrolled to attain a 100 percent net enrollment rate. This calculation is made separately for recurrent costs and capital costs. Over 15 years, the average annual recurrent cost is about $7 billion. Total capital costs are estimated to be $0.6 billion. An estimate is also made of the cost of increasing school quality, primarily by spending at least 15 percent of recurrent expenditures on items other than teacher salaries; this spending affects all pupils, not just those who have been added to attain universal enrollment. The cost of this additional expenditure is estimated to be $1.1 billion dollars. Another relatively simple calculation to account for improved school quality is to add the cost of hiring enough teachers to attain a pupil-teacher ratio of

5. Recall that UPC was defined above as 95 percent or more of all children finishing primary school; this is a slightly lower goal than the 100 percent completion that would be achieved with a net primary enrollment rate of 100 percent and no grade repetition.

40 in countries where the pupil-teacher ratio is higher than 40. This entails an additional cost of about $0.5 billion. Adding these costs together, the total average annual cost from 2000 to 2015 is $9.1 billion. The paper does not divide this amount into the portion that would be borne by the countries and the portion that would need to be financed by donors.

### *A UNESCO Estimate*

An unpublished paper written by UNESCO staff presents a third estimate of the cost of attaining UPC by 2015 (Brossard and Gacougnolle, 2001). The authors begin by forecasting the primary school age population for each country in 2015 using United Nations population estimates. After making a small adjustment to account for the 1–2 percent of primary school age children who are in secondary school, they multiply the net enrollment rate by the forecast of the primary school age population. This determines the number of primary school age children enrolled in primary school in 1997. In developing countries, many children enrolled in primary school are older than the official primary school age. For each country, the authors calculate the proportion of children enrolled in primary school who are of primary school age and use the inverse of this proportion as an "inflation factor" to convert the number of primary school age children enrolled in primary school in 1997 to the total number of children enrolled in primary school, regardless of age.

These calculations generate a formula that expresses total enrollment in primary school as the product of the net enrollment rate, the number of children of primary school age, and the inverse of the proportion of children in primary school who are of primary school age. This formula accounts for grade repetition. That is, because repetition results in secondary school age children still enrolled in primary school, the number of children who will be enrolled in primary school to achieve UPC will exceed the number of primary school age children. The authors forecast that there will be 595 million children of primary school age in developing countries in 2015 but that 693 million children must be enrolled in primary school at that time to achieve UPC.[6] The additional 98 million children are repeaters. The UNESCO data show that 571 million children were enrolled in primary school in 1997, so the authors estimate the cost of increasing total enrollment by 122 million (to reach 693 million) by 2015.[7] To estimate the cost of recurrent educational expenditures, they calculate recurrent expenditure per pupil for each country in 1997. It is possible to decompose recurrent expenditures per pupil into the product of recurrent expenditures per teacher and current teachers per pupil (the inverse of the pupil-teacher ratio). This decomposition is used in one scenario, described below. The authors also incorporate capital costs (unlike the early

6. The figure of 693 million children was obtained by using the formula given above, after setting the net enrollment rate to 100 percent.

7. It is not clear why this figure is lower than the 170 million figure given in the UNICEF report; neither report provides a comprehensive explanation of data or methodology.

World Bank estimate), but in a simple manner. They assume that capital costs are a constant proportion of recurrent costs.

Brossard and Gacougnolle consider three scenarios to estimate the cost of achieving UPC. The first assumes that spending per pupil is unchanged (and thus that the pupil-teacher ratio is unchanged) and, for each country, multiplies spending per pupil by the number of pupils that need to be added to attain a net primary enrollment rate of 100 percent.[8] Using this scenario, the authors estimate that annual costs must increase by $26 billion (1995 U.S. dollars), from $99 billion in 1997 to $125 billion in 2015.

The second scenario adds the quality improvement of reducing the pupil-teacher ratio by 10 percent in each country. This increases the per pupil recurrent cost by about 11 percent, not only for newly added students but also for students currently in school. The total cost for UPC rises to $133 billion, which implies a financing gap of $34 billion. The third scenario includes a cost-savings assumption, where new teachers hired under the second assumption can be paid only 70 percent of what current teachers are paid. This reduces the cost of UPC by $2 billion and thus reduces the financing gap to $32 billion. All cost figures in each of the three scenarios are *annual* figures. If gradual increases begin in 1997, the total amount over the entire 18-year period for each scenario would be $263 billion, $338 billion, and $320 billion, respectively.[9]

*Some Problems with these Estimates*

All three of these studies needed to make simplifying assumptions to obtain their estimates, and the assumptions made tend to ignore or avoid complicating factors. The more simplifying assumptions made in a study, however, the more likely it is that the estimates are inaccurate. The assumptions of these studies are summarized in Table 7.

The Devarajan et al. study makes the greatest number of simplifying assumptions. It ignores capital costs, economic growth, the spread of AIDS in many Sub-Saharan African countries, private schools, and grade repetition. Four of these five assumptions are likely to lead to underestimation of the cost, the sole exception being the role of private schools. Ignoring capital costs clearly underestimates the total cost. Ignoring the spread of AIDS also underestimates the cost because many teachers with AIDS will be absent for long periods of time, may require medical care, and will die at an early age (which implies that a new teacher must be trained). Although ignoring economic growth may, at first glance, appear to overestimate costs because growing economies have more resources to pay for education, a growing economy also generates higher wages, which leads to an increase in teacher salaries. Ignoring grade repetition underestimates costs because children who repeat grades take more time in school to finish primary schooling, which increases the number of children in school at any point in time. Ignoring the

8. Adding this number of pupils over all developing countries leads to the 122 million figure used in the study.

9. These figures are calculated by multiplying the annual figures listed in Table 15 of the paper by 18.

**Table 7**: Selected Characteristics of the Four Cost Studies

| | Devarajan | UNESCO | UNICEF | Bruns |
|---|---|---|---|---|
| Includes capital costs? | No | Yes | Yes | Yes |
| Allows for economic growth? | No | No | No | Yes |
| Include AIDS & orphan cost? | No | No | No | Yes |
| Adjusts for private schools? | No | No | No | Yes |
| Accounts for repeaters? | No | No | Yes | Yes |
| Scenarios to raise school quality? | No | Yes | Yes | Yes |
| Cost comparison made | Adding new students, relative to current students | Adding new students, relative to current students | Adding new students, relative to current students | Gap in what countries can finance and what is needed |
| Number of countries included in cost comparison | About 150 | 151 | 128 | 47 |
| Annual cost estimate, billions US$ | 10–15 | 9 | 14–17 | 0–6 |

Sources: Authors' summary based on the four studies.

role of private schools, on the other hand, leads to an overestimate of costs. Private schools are financed by parents or private organizations (e.g. churches), so an increased number of students in private schools decreases the financial burden on public schools (and thus on the government budget).

Brossard and Gacougnolle improve on Devarajan et al. by incorporating capital costs (although their method for doing so is not clearly described). They explicitly recognize their omission of additional costs resulting from the spread of AIDS. They ignore economic growth, grade repetition, and private schools. Delamonica et al. make further improvements. They account for grade repetition and capital costs, but not costs due to AIDS, the impact of economic growth on costs, nor children who attend private schools.

These three studies arrive at estimates of the annual costs of achieving UPC between $9 billion and $17 billion. The narrow range of results is not surprising because these methods have more similarities than differences. A fourth study, the World Bank study by Bruns and her coauthors discussed in more detail below, addresses many of the shortcomings raised in this subsection, though not always convincingly.

### *The Most Serious Problem with these Estimates*

Unfortunately, these three studies and the Bruns et al. study suffer from a shortcoming that will be almost impossible to address at a global level, although data from some countries may allow researchers to address it at the national level. The problem is that they make no attempt to answer the first question raised in the introduction to this paper: What policy changes can bring about UPC in developing countries?

In the studies discussed, the number of children to be enrolled in school is multiplied by the cost per student, the latter usually based on current average costs per student. Such exercises are useful under two possible scenarios. First, if some policy were developed that persuaded all parents to enroll their primary school age children, the cost of accommodating these students while maintaining current pupil-teacher ratios and other costs would be useful to know. Yet this would only be one part of the cost of attaining UPC, because the policy itself, whatever it may be, would also have a cost. Moreover, the calculation assumes that the (marginal) cost of educating children who are currently not enrolled in school is equal to the average cost for currently enrolled children, which is unlikely to be true.

The second scenario that makes such exercises useful is one in which the main reason that children of primary school age are not enrolled in school is that there are no schools available. Either the nearest school is too far away or the nearest school is full and cannot admit any more students. One way to phrase this scenario is to say, "If you build the schools, they will come."[10]

Unfortunately, the assumption behind this second interpretation is unlikely to be true in many developing countries. In western Honduras, for example, only about half of all children finish primary school (Glewwe and Olinto, 2004). In a household questionnaire administered in 2000 to 5768 households in 80 municipalities, 50 percent of households reported that the nearest primary school is within a 10 minute walk and 90 percent reported that the nearest primary school is within a 30 minute walk. School access is not a major problem, even in communities where primary school completion rates are low. According to a questionnaire administered in the same municipalities in 2002 (the following figures are from the 20 municipalities that were the control group), among 1525 children age 7–12, 94 percent had started school but 9 percent of these (130 children) had already dropped out and thus would not finish primary school. Parents reported the main reasons their children had dropped out. The three main reasons were: child not interested in school (36 percent), "economic problems" (19 percent), and child must work (9 percent). Only 8 percent reported lack of a nearby school as the problem. In Honduras, although many schools have been built, a substantial fraction of children do not attend.

In India, the primary completion rate was 76 percent in 1999. For most of the population, distance to the nearest primary school in India is very low; in 1993, 94 percent of the rural population lived within one kilometer of a primary school (PROBE Team, 1999).

In Ghana, parents of out-of-school children aged 6 to 21 were asked to report the main reason why their children were not enrolled (World Bank, 2004). The two reasons given most frequently were: school is too expensive

10. A closely related interpretation would supplement the construction of schools and hiring more teachers with enforcement of a compulsory schooling law. This can be paraphrased as "Build the schools and force them to come." In developing countries, however, such laws are rarely, if ever, enforced, because governments in those countries have neither the personnel nor the political will to enforce compulsory schooling laws.

or child is needed to work at home (46 percent) and parents view education as having little value (22 percent). Only 7 percent reported that the school is too far away or of low quality. When primary school head teachers were asked the same question, 78 percent responded that the main reason children were not enrolled was that school is too expensive and/or the child is needed at home. Only 2 percent said that the school is too far away or of low quality.

Indonesia may offer a counterexample. Duflo (2001) points out that a major expansion in the number of schools in Indonesia in the 1970s coincided with an increase in the primary enrollment rate from about 69 percent in 1973 to about 83 percent in 1978. Yet school construction was only one aspect of a larger plan to promote education. For example, in 1978 the Indonesian government removed all primary school enrollment fees. Moreover, the massive increase in primary school construction (which doubled the number of primary schools in Indonesia in seven years) still did not lead to 100 percent enrollment rates. Even in countries that continue to have serious problems with school availability (the Indonesian example is quite dated) there is no evidence that building more schools is sufficient to attain UPC.

The unfortunate conclusion to draw about the cost estimates of the studies discussed above, as well as the Bruns et al. study discussed below, is that they either beg the question of how UPC will be achieved or they are based on the grossly inaccurate assumption that the only obstacle to UPC is a shortage of schools. A different method for estimating the cost of attaining UPC for a few countries is presented below, after a discussion of the cost estimates made by Bruns et al.

## MECHANICS OF THE NEW WORLD BANK COST ESTIMATES

The most comprehensive estimates of the cost of attaining UPC by 2015 are those developed at the World Bank by Bruns, Mingat, and Rakotomalala (2003). The methodology used in this study is explained in detail below, with emphasis on the assumptions made, and their implications. Although these estimates are still subject to the important criticism made above, they warrant a detailed presentation. In addition to explaining the methodology, some simulations are presented, to demonstrate what underlies the estimates produced by this report.

### *Assumptions*

All methods used to estimate the costs of attaining UPC must make some assumptions. Perhaps the most basic assumption is what the population growth rate will be, because that determines how many children of school age there will be in each future year. The World Bank assumes no change in the population growth rate over time. This means that the population growth rate is assumed to remain unchanged between 2000 and 2015.[11] This

11. For some countries the population growth rate is not for the year 2000 but for another year, usually 1997, 1998, or 1999.

is a reasonable assumption, given that the projections are made only to the year 2015, and population growth rates change slowly over time. For developing countries as a whole the population growth rate changed very little from 1980 to 1990, dropping from 1.9 percent to 1.8 percent, although the rate dropped more quickly from 1990 to 2000 (to 1.3 percent).

Another assumption that has important implications for costs is the grade-repetition rate, because this rate determines the actual number of years, on average, that a child spends in primary school. The World Bank presents two scenarios, a "base scenario" for which repetition rates are assumed to be constant from 2000 to 2015, and an "efficiency improvement" scenario. The second scenario assumes no change for countries with a repetition rate below 10 percent and a gradual reduction in grade repetition to 10 percent in 2015 for countries with a rate greater than 10 percent in 2000.

A third assumption concerns economic growth. A country with a growing economy will have more internal resources to pay for education, but a growing economy will also lead to higher incomes and therefore higher teacher salaries, increasing the total cost of UPC. Moreover, forecasting future economic growth is very difficult. The World Bank report assumes, without much explanation, a rate of GDP growth of 5 percent per year. Of course, per capita economic growth will vary according to population growth rates; countries with higher population growth rates will have lower growth rates in per capita GDP.

*Equations*

The equations used in the World Bank estimates are presented below. Italicized variables are those for which direct assumptions are made (e.g. the population growth rate is assumed to remain unchanged), while variables not in italics are calculated as functions of the direct assumptions (e.g. per capita GDP is calculated based on the assumptions concerning GDP growth and population growth). Thus, each scenario is a set of assumptions about the variables in italics, and these are then used to calculate a number of intermediary cost variables and, eventually, the overall (simulated) cost. The presentation below begins with the equation for overall cost, and works backward toward the underlying assumptions.

In the World Bank estimates, the total cost at time t ($tc_t$) of primary schooling in a given country is the sum of four distinct costs (all at time t), capital costs ($kc_t$), recurrent costs ($rc_t$), costs associated with the prevalence of HIV/AIDS ($hivc_t$), and costs associated with the percentage of children of primary school age who are orphans ($orc_t$), most of whom have become orphans because their parents have died of AIDS:

$$tc_t = kc_t + rc_t + hivc_t + orc_t \quad (1)$$

Capital costs ($kc_t$) result from the construction of new classrooms (often through the construction of new schools) to accommodate an increase in the number of children. Thus capital costs are the product of the new classrooms required ($newcls_t$) and the cost of their construction ($clsc_t$):

$$kc_t = newcls_t \times clsc_t \quad (2)$$

The cost of classroom construction ($clsc_t$) is in italics to indicate that this variable needs no further calculation; for each country, Bruns et al. set $clsc_t$ at values that "regional experts consider to be a 'good practice' level" (2003: 143).

To calculate the variable $newcls_t$ in equation (2), the methodology assumes that the costs are incurred in the year before the new classrooms are first used. Thus the number of new classrooms constructed in year t is determined by the increase in the number of students from year t to year t+1, adjusted for pupil-teacher ratios and the number of teachers in each classroom (in many developing countries several classes, each with their own teacher, may meet in the same classroom). The number of new classrooms required depends on changes in the number of teachers (numtch) and changes in the number of teachers per classroom (*tchpcls*), the latter being one indicator of school quality:

$$newcls_t = numtch_{t+1}/tchpcls_{t+1} - numtch_t/tchpcls_t \quad (3)$$

The number of teachers in any year ($numtch_t$) is determined by the number of students in primary school ($totstud_t$) divided by the primary level pupil-teacher ratio ($puptchrat_t$):

$$numtch_t = totstud_t/puptchrat_t \quad (4)$$

The number of students is determined by the total population of the country ($totpop_t$), the fraction of the population that are of primary school age ($primage\%_t$), the gross enrollment rate ($ger_t$) and the percent of primary school students who are in private schools ($priv\%_t$):

$$totstud_t = (primage\%_t \times totpop_t) \times ger_t \times (1 - priv\%_t) \quad (5)$$

The last step is to calculate the gross enrollment rate. If all children enroll in primary school at the standard age (e.g., 6 years old) and there were no grade repetition, it would equal the average, over different ages (6 years, 7 years, etc.) of the number of children enrolled divided by the total number of children of that age. For the first year of primary schooling, this would be the intake rate (*inrate*) into primary school (the proportion of children who eventually enroll in primary school), and for the last year of primary school this would be the primary school completion rate (*comprate*). The World Bank authors make the plausible assumption that the average over all grades is approximately the average over the first and last grades, i.e., (*inrate* + *comprate*)/2. The last issue to consider is grade repetition. Repetition adds to the gross number of children enrolled in primary school, raising the gross enrollment rate:

$$ger_t = [(inrate_t + comprate_t)/2] \times (1 + reprate_t) \quad (6)$$

The variable $reprate_t$ is the repetition rate in primary school. This completes the discussion of the first term in equation (1), capital costs.

The next term in equation (1) is recurrent costs. This can be divided into teacher salary costs ($tsal_t$) and other (non-teacher) costs. Expressing the latter as a multiple of teacher salary costs (*ntc%tsal*) gives:

$$rc_t = tsal_t \times (1 + ntc\%tsal) \quad (7)$$

In the simulations below, *ntc%tsal* is set at its value in the year 2000, unless indicated otherwise.

Teacher salary costs are in turn determined by the number of teachers ($numtch_t$) and the average teacher salary, the latter of which can be expressed as the ratio of a teacher's salary as a function of per capita GDP (this ratio will be denoted as $tsal\%gdppc_t$) and per capita GDP ($gdppc_t$, which is simply total GDP, denoted as $gdp_t$, divided by total population, $totpop_t$):

$$\begin{aligned} tsal_t &= numtch_t \times [tsal\%gdppc_t \times gdppc_t] \\ &= numtch_t \times [tsal\%gdppc_t \times (gdp_t / totpop_t)] \end{aligned} \quad (8)$$

Recall that $numtch_t$ was explained in equations (4), (5), and (6).

The third component of total costs in equation (1) is costs due to HIV/AIDS. It is calculated as a percentage increment to teacher salaries,

$$hivc_t = hiv\%tsal_t \times tsal_t \quad (9)$$

where $tsal_t$ is derived as in equation (8). The increment ($hiv\%tsal_t$) is calculated based on the proportion of teachers with HIV/AIDS (assumed to be the same as that in the general population) and estimates that a teacher with HIV/AIDS will die after about 10 years and during those years will be absent from school (and thus a substitute will need to be hired) for 260 school days over those 10 years.[12] The cost of training new teachers to replace those who die is not incorporated into these cost estimates.

The final component of total costs in equation (1) is orphan costs. This component is calculated as the cost per orphan (*orcpo*) multiplied by the number of students who are orphans (which is the total number of students divided by the percent of students that are orphans, *orphan%*):

$$orc_t = orcpo_t \times orphan\%_t \times totstud_t \quad (10)$$

Recall that total students is given above in equation (5). The cost per orphan is in effect the cost of a subsidy given to orphans to support their school expenses, which is assumed to be $50 per month for all countries.

Substituting equations (2) through (10) into equation (1) gives the overall equation for simulating total costs of primary education for each country for each year. The variables in italics are directly determined by the assumptions of the model. Different assumptions will produce different estimates of total cost.

The above equations are used to calculate the total cost of attaining UPC in each country. The final step is to calculate the domestic financial resources that each country can provide, and any gap between this number and the total cost represents a need for international assistance to achieve UPC. Domestic financial resources ($domres_t$) are assumed to be the product of four factors: gross domestic product ($gdp_t$), government revenue as a percent of gross domestic product ($gvrv\%gdp$), education spending as a percent of government revenue ($edsp\%gvrv$), and the percent of government spending on education that is allocated to primary education ($prsp\%edsp$):

12. For details and references, see Bruns et al., p. 77.

$$\text{domres}_t = gdp_t \times gvrv\%gdp_t \times edsp\%gvrv_t \times prsp\%edsp_t \quad (11)$$

In the simulations, $gvrv\%gdp_t$ is set at 14 percent for the poorest low-income counties, 16 percent for low-income countries whose per capita GDP is between about $300 and about $500, and 18 percent for low-income countries with a per capita GDP greater than about $500 (this rule was not strictly followed, but it is not clear how the exceptions were made). The percent of government revenue devoted to education ($edsp\%gvrv_t$) was set to 20 percent for all countries, and the percent of education spending allocated to primary education ($prsp\%edsp_t$) was set to 50 percent for countries with a six-year primary cycle and 42 percent for countries with a five-year primary cycle.

*Simulations*

Using the methodology just described, Bruns and her coauthors present six simulations of the cost of attaining UPC. For each simulation, there are three outcomes: total cost, domestic resources, and the gap between the total cost and domestic resources. These simulations are limited to the 47 low-income countries that are off track. In addition to the simulations done by Bruns, et al., this paper undertakes several others to understand better the workings of the methodology.

The first simulation, referred to as Scenario 1, calculates cost, resources, and the gap between cost and resources after gradually increasing the intake rate and the completion rate in equation (6) to be 100 percent.[13] All other parameters (variables in italics) are left unchanged. The total cost over 15 years for the 47 countries in the simulation is $208 billion dollars, and the total resources available is about $170 billion. The financing gap is $38 billion spread over 15 years, which implies a modest donor increase of only $2.5 billion per year. Nearly 80 percent of this gap ($30 billion) is for Sub-Saharan African countries, and most of the rest ($6.6 billion) is for South Asia.

This cost estimate is not comparable to those of the three previous studies. Those studies estimated the *additional* cost of getting unenrolled children into school, which can be calculated as the difference between the total cost calculated in the World Bank Scenario 1 and the total cost of maintaining primary school enrollment at the current number from 2000 to 2015. This was not calculated in the World Bank but it is given here, in Scenario 13(a). The total in this case is $110 billion, which, when compared to Scenario 1, implies that the incremental cost of attaining UPC by 2015 in these 47 countries will be $98 billion. Divided over 15 years, this implies an incremental cost of $6.5 billion per year. This is smaller than all the cost estimates of the other studies, primarily because it excludes countries that are on track even though they have not yet attained UPC.

Scenario 13(a) assumes that, in the absence of a concerted international effort, primary school enrollment will remain the same. One could also argue

13. The intake rate reaches 100 percent by 2010, and the completion rate reaches 100 percent by 2015.

that "doing nothing" does not mean that enrollment will be fixed for the next 15 years. Two alternative scenarios are: 1) the proportion of children enrolled (relative to the number of school age children) is unchanged; and 2) the enrollment trend from 2000 to 2015 follows the same (linear) trend that it followed from 1990 to 2000. These are Scenarios 13(b) and 13(c), respectively. In each case, the cost suggests a somewhat smaller incremental gap—$74 billion in the former and $86 billion in the latter—which reduces the annual cost to about $5 billion and $5.7 billion, respectively.

The scenario that receives the most attention in the Bruns et al. study is Scenario 5 (see Table 8). This calculates the cost of achieving UPC by 2015 while simultaneously improving school quality,[14] enhancing efficiency,[15] and increasing mobilization of domestic financial resources. Under this scenario, the total cost of attaining UPC by 2015 would increase to $244 billion, but domestic resources would also increase, to $213 billion, so the financing gap is slightly lower, at $31 billion over 15 years (about $2 billion per year).

Scenarios 2, 3, 4, and 6 (see Table 8) are the other scenarios presented in the Bruns et al. book. Scenarios 7–12 are "experiments" that consider what happens to the estimates when some parameters are changed. One potential criticism of the World Bank scenarios is that they assume GDP growth rates of 5 percent, which may be too optimistic, especially for Sub-Saharan African countries. Scenario 7 uses the assumptions of Scenario 5 but assumes that GDP growth from 2000 to 2015 will equal the average GDP growth rate from 1990 to 2000 (instead of assuming 5 percent GDP growth). Very little happens when this assumption is changed. Domestic resources decline slightly, but costs also decline (because teacher salaries, tied to GDP per capita, decline slightly). Scenario 8 uses IMF projections for the GDP growth rate. IMF projections are optimistic in assuming higher than 5 percent growth in most regions, but the increase in resources is matched by increased costs in teacher salaries, so again there is little effect on the gap. Scenario 9 assumes a more pessimistic GDP growth of only 3 percent. As expected, domestic resources drop, but the drop in domestic costs is almost the same, so that there is very little change in the financing gap compared to Scenario 5. Scenario 10 assumes a smaller fraction of students in private schools, but this has little effect on the simulation results.

A much different picture emerges if teacher salaries are held constant even though GDP growth is 5 percent. Scenario 11 implements the base case of Scenario 1, with one change: teacher salaries are held constant. There is no change in domestic resources, but domestic costs drop by about $46 billion. This results in an overall surplus of about $8 billion, although it is still the case that Sub-Saharan Africa has a financing gap of about $14 billion.

14. Improvement in school quality is incorporated primarily through a reduction in the pupil-teacher ratio in countries where that number is higher than 40, but also through an increase in teacher salaries and "non-teacher" spending for some countries.

15. Efficiency enhancement is calculated as a reduction in teacher salaries in countries with relatively high teacher salaries and in raising pupil-teacher ratios to 40 in countries where they are less than 40.

**Table 8**: Simulation Results Using World Bank Methodology (Bruns et al., 2003)

| Region | Total Cost (millions US $) | Domestic Resources (millions US $) | Financing Gap (millions US $) |
|---|---|---|---|
| ***Scenario 1:*** *Base Estimate* | | | |
| Sub-Saharan Africa | 84,650 | 54,632 | -30,018 |
| South Asia | 113,439 | 106,816 | -6623 |
| East Asia and Pacific | 874 | 1094 | 220 |
| Latin American and Caribbean | 1957 | 1718 | -238 |
| Middle East and North Africa | 7084 | 5603 | -1480 |
| Total | 208,004 | 169,864 | -38,140 |
| ***Scenario 2:*** *Improve School Quality (reduce student-teacher ratio to 40 and, in some countries, raise teacher salaries and non-teacher spending)* | | | |
| Sub-Saharan Africa | 110,113 | 54,632 | -55,480 |
| South Asia | 139,458 | 106,816 | -32,641 |
| East Asia and Pacific | 2491 | 1094 | -1397 |
| Latin American and Caribbean | 2266 | 1718 | -546 |
| Middle East and North Africa | 7948 | 5603 | -2344 |
| Total | 262,275 | 169,864 | -92,410 |
| ***Scenario 3:*** *Improve Quality and Raise Efficiency (reduce teacher salaries in countries with very high salaries, and raise student-teacher ratio to 40 in countries where it is less than 40)* | | | |
| Sub-Saharan Africa | 90,925 | 54,632 | -36,293 |
| South Asia | 140,690 | 106,816 | -33,874 |
| East Asia and Pacific | 2177 | 1094 | -1083 |
| Latin American and Caribbean | 2000 | 1718 | -282 |
| Middle East and North Africa | 5884 | 5603 | -281 |
| Total | 241,676 | 169,864 | -71,812 |
| ***Scenario 4:*** *Improve Quality and Efficiency, and Mobilize Domestic Resources* | | | |
| Sub-Saharan Africa | 88,132 | 63,216 | -24,916 |
| South Asia | 145,677 | 147,631 | 1954 |
| East Asia and Pacific | 2050 | 1713 | -337 |
| Latin American and Caribbean | 2623 | 2003 | -620 |
| Middle East and North Africa | 5620 | 4423 | -1197 |
| Total | 244,104 | 218,987 | -25,116 |
| ***Scenario 5:*** *Improve Quality and Efficiency, and Mobilize Domestic Resources* | | | |
| Sub-Saharan Africa | 88,132 | 59,828 | -28,304 |
| South Asia | 145,677 | 145,232 | -446 |
| East Asia and Pacific | 2050 | 1619 | -431 |
| Latin American and Caribbean | 2623 | 1985 | -639 |
| Middle East and North Africa | 5620 | 4423 | -1197 |
| Total | 244,104 | 213,086 | -31,017 |
| ***Scenario 6:*** *Improve Quality and Efficiency, and Mobilize Domestic Resources* | | | |
| Sub-Saharan Africa | 88,132 | 78,538 | -9594 |
| South Asia | 145,677 | 167,999 | 22,321 |
| East Asia and Pacific | 2050 | 2029 | -22 |
| Latin American and Caribbean | 2623 | 2266 | -358 |
| Middle East and North Africa | 5620 | 6658 | 1038 |
| Total | 244,104 | 257,489 | 13,384 |

| Region | Total Cost (millions US $) | Domestic Resources (millions US $) | Financing Gap (millions US $) |
|---|---|---|---|
| ***Scenario 7:*** *Scenario 5, but GDP growth is same as average growth from 1990 to 2000* | | | |
| Sub-Saharan Africa | 76,738 | 50,675 | -26,063 |
| South Asia | 152,798 | 153,507 | 709 |
| East Asia and Pacific | 2043 | 1587 | -457 |
| Latin American and Caribbean | 1789 | 1287 | -501 |
| Middle East and North Africa | 5910 | 4672 | -1238 |
| Total | 239,278 | 211,728 | -27,550 |
| ***Scenario 8:*** *Scenario 5, but GDP growth is assumed to follow IMF projections* | | | |
| Sub-Saharan Africa | 84,936 | 57,289 | -27,647 |
| South Asia | 171,792 | 173,287 | 1495 |
| East Asia and Pacific | 2427 | 1932 | -495 |
| Latin American and Caribbean | 2005 | 1455 | -550 |
| Middle East and North Africa | 5549 | 4359 | -1190 |
| Total | 266,708 | 23,833 | -28,386 |
| ***Scenario 9:*** *Scenario 5, but GDP growth is assumed to be 3 percent* | | | |
| Sub-Saharan Africa | 76,097 | 50,321 | -25,776 |
| South Asia | 123,408 | 121,451 | -1957 |
| East Asia and Pacific | 1734 | 1356 | -378 |
| Latin American and Caribbean | 2034 | 1482 | -552 |
| Middle East and North Africa | 4882 | 3786 | -1096 |
| Total | 208,155 | 178,396 | -29,759 |
| ***Scenario 10:*** *Scenario 5, but reduce the fraction of students in private schools* | | | |
| Sub-Saharan Africa | 79,161 | 50,675 | -28,486 |
| South Asia | 153,326 | 153,507 | 181 |
| East Asia and Pacific | 2046 | 1587 | -460 |
| Latin American and Caribbean | 1833 | 1287 | -546 |
| Middle East and North Africa | 5910 | 4671 | -1238 |
| Total | 242,276 | 211,728 | -30,548 |
| ***Scenario 11:*** *Scenario 1, but teacher salaries are not increased over time* | | | |
| Sub-Saharan Africa | 68,486 | 54,632 | -13,854 |
| South Asia | 85,422 | 106,816 | 21,394 |
| East Asia and Pacific | 675 | 1094 | 419 |
| Latin American and Caribbean | 1519 | 1718 | 200 |
| Middle East and North Africa | 5694 | 5603 | -91 |
| Total | 161,796 | 169,864 | 8068 |
| ***Scenario 12:*** *Scenario 1, but no new teachers are hired and no classrooms are built (student-teacher ratio increases)* | | | |
| Sub-Saharan Africa | 42,545 | 50,675 | 8131 |
| South Asia | 112,208 | 153,507 | 41,299 |
| East Asia and Pacific | 2270 | 1587 | -684 |
| Latin American and Caribbean | 1013 | 1287 | 274 |
| Middle East and North Africa | 5389 | 4672 | -717 |
| Total | 163,425 | 211,727 | 48,303 |

| Region | Total Cost (millions US $) | Domestic Resources (millions US $) | Financing Gap (millions US $) |
|---|---|---|---|
| ***Scenario 13(a):*** *Enrollment levels remain at 2000 levels* | | | |
| Sub-Saharan Africa | 34,501 | 42,171 | 6770 |
| South Asia | 69,211 | 79,167 | 9956 |
| East Asia and Pacific | 717 | 823 | 107 |
| Latin American and Caribbean | 1035 | 1235 | 200 |
| Middle East and North Africa | 3710 | 4419 | 709 |
| Total | 110,073 | 127,815 | 17,742 |
| ***Scenario 13(b):*** *Enrollment rates stay at 2000 rates* | | | |
| Sub-Saharan Africa | 45,675 | 42,171 | -3503 |
| South Asia | 81,277 | 79,167 | -2110 |
| East Asia and Pacific | 975 | 823 | -152 |
| Latin American and Caribbean | 1335 | 1235 | -101 |
| Middle East and North Africa | 4887 | 4419 | -468 |
| Total | 134,149 | 127,815 | -6334 |
| ***Scenario 13(c):*** *Enrollment trends are the same as the trends from 1990 to 2000* | | | |
| Sub-Saharan Africa | 36,479 | 42,171 | 5692 |
| South Asia | 79,612 | 79,167 | -445 |
| East Asia and Pacific | 716 | 823 | 107 |
| Latin American and Caribbean | 1587 | 1235 | -352 |
| Middle East and North Africa | 3619 | 4419 | 800 |
| Total | 122,013 | 127,815 | 5802 |

Sources: Authors' simulations based on data from World Bank (2002) and Bruns et al. (2003).

Scenario 12 examines the result if pupil-teacher ratios are allowed to rise as more students are enrolled (all other assumptions are the same as those in Scenario 5). This means that no new schools are built and no new teachers are hired; in effect, more children are crowded into existing classrooms. Under this scenario, costs are much lower than domestic resources, leading to a financing surplus of $48 billion. Even Sub-Saharan Africa has such a surplus, about $8 billion. However, the implied pupil-teacher ratios are quite high in some regions. For Sub-Saharan Africa, the ratio rises from 47 to 83, and in Latin America it rises from 43 to 88.[16]

## MORE CREDIBLE EVIDENCE ON THE COST OF UNIVERSAL PRIMARY COMPLETION

The assumptions underlying all of the above cost estimates, including the Bruns et al. World Bank estimates, are doubtful. As discussed above, none of the studies considers the reasons why primary school age children are not enrolled in school. The cost estimates are meaningful only if the main reason that children are not enrolled is that no school is available, but this is unlikely to be the case.

16. The very high figure for Latin America reflects the dramatic increase in Haiti, which is one of only two countries in that region not expected to attain UPC by 2015.

If the main problem is not lack of schools, how might additional funds be used to increase school enrollment? One possibility is to subsidize schooling by providing payments to parents conditional on their children being enrolled. This subsidy has been offered in several countries (e.g., Bangladesh, Brazil, Chile, Honduras, Mexico, and Nicaragua). In a few of these countries, policies providing subsidies were implemented using randomized trials, which probably provide the best estimates of the impact of such policies on school enrollment. Honduras and Nicaragua provide two recent examples. Glewwe and Olinto (2004) report that subsidies to Honduran parents to enroll their children in school, worth about $50 per year per child (about 3 percent of annual household expenditures), increased enrollment rates about 1–2 percentage points. In Nicaragua, the subsidies were much larger, about $112 per child per year (about 18 percent of annual household expenditures). Maluccio and Flores (2004) report that school enrollment rates increased by 16 percentage points, from about 77 percent to about 93 percent. Estimates reported by Morley and Coady (2003) for Nicaragua suggest that the intervention raises the probability of a Nicaraguan child entering the fifth grade, conditional on starting first grade, from 55 percent to 80 percent. These increases in enrollment in Honduras and Nicaragua were not accompanied by the construction of new schools, although some new teachers may have been hired; thus, it is likely that pupil-teacher ratios increased. However, the evidence from developing countries shows that pupil-teacher ratios have little effect on student learning (Hanushek, 1995), so it may be unnecessary to reduce class size to previous levels.

Consider the case of Nicaragua in more detail. Using the World Bank methodology, the assumption that enrollment rates remain constant (the "doing nothing" scenario) implies that it will cost $979 million over the next 15 years to fund primary schools in Nicaragua. The cost of the "build more schools and they will come" approach, as simulated by Bruns et al. Scenario 1, is $1,050 million. The incremental cost over 15 years is about $71 million, or about $5 million per year.

In contrast to this cost estimate, consider the cost of providing subsidies to attend schools in poor rural areas. The total number of primary age children in Nicaragua in 2000 was about 600,000 children, about half from rural areas. The study discussed above suggests that a $112 annual subsidy per child will increase the percentage of children who reach grade 5, conditional on starting school, from about 55 percent to 80 percent. Under the assumption that half of children in rural areas need assistance to be induced to stay in school, providing the subsidy to about 150,000 Nicaraguan children will cost about $17 million annually. This is 3–4 times higher than the annual cost of achieving UPC implied by the World Bank report and can be expected to achieve only 80 percent completion of grade 5. This rough calculation suggests that the costs of achieving UPC through such a program will be much higher than the "build the schools and they will come" approach. The data from Honduras, in which a $50 per year subsidy increased the enrollment rate by only 1–2 percentage points, also suggest that using subsidies will

be much more expensive then the "build the schools and they will come" approach.

There may be other ways to attract children to school, but there is currently very little research on this subject. An important exception, doubly important because it examines a poor African country, is a study by Miguel and Kremer (2004) of the impact that providing medical treatment for intestinal parasites has on school attendance. The study found that providing low-cost (49 cents per student per year) deworming medicine increased school participation (which incorporates both attendance and enrollment) by seven percentage points. While this impact is not very large from the viewpoint of reaching UPC, it highlights one less expensive alternative to subsidies. This particular alternative applies only in settings where a high percentage of children have moderate to heavy levels of intestinal parasites, which is not the case for most developing countries,[17] but it suggests that health may be a significant factor in determining whether children enroll and participate in primary school. It is possible that programs for improving child health will need to be a part of policies to achieve UPC, and therefore the cost of such programs must be incorporated into estimates of the cost of attaining UPC.

The approach used by the studies reviewed in this paper is based on an incorrect, or at least incomplete, understanding of why many children in developing countries do not complete primary school. No one knows how much it will cost to attain universal primary school completion, because no one knows what policies can achieve that goal. Effective policies to promote universal primary education, and the calculation of its cost, must be based on new research on the determinants of school enrollment in developing countries.

## CONCLUSION

Developing countries are making steady progress toward UPC, but at the current rates of improvement it is unlikely that they will attain that goal by 2015. Lagging far behind the rest of the world, Sub-Saharan Africa had an average primary school completion rate of 53 percent in 2000 and this number is projected to remain at 53 percent in 2015. In all other regions, the projected primary completion rate by 2015 is near 90 percent or higher (the lowest being South Asia and the Middle East and North Africa, both of which have a projected rate of 87 percent). The introduction to this paper posed two questions: What policy changes can bring about UPC in developing countries? How much additional money will be needed to implement those policies?

Though they claim to do so, none of the four recent studies reviewed in this paper adequately answers the second question, because none identifies policies that can bring about UPC. These studies focus on how much it will

17. Miguel and Kremer report infection levels of 200 million to 1.3 billion, depending on the type of parasite, compared to a total population in developing countries of about 5 billion, but they also note that most of these infections are "light."

cost to build new classrooms and to hire new teachers to accommodate children currently not in school, but building new schools does not always mean that children will come. In many developing countries, schools are available but millions of parents choose not to enroll their children in those schools. Only a thorough investigation of the choices made by parents, especially in the countries of Sub-Saharan Africa, will reveal what is required to persuade parents to enroll their children, and only then will it be possible to calculate the cost of achieving UPC. This research is a critical task for researchers and development agencies. Recent research from Latin America on the use of subsidies suggests that this method can be effective, but the cost may by three to four times higher than the expense of building new classrooms and hiring more teachers. Although there is less evidence from Sub-Saharan Africa on the effectiveness of subsidies on school enrollment, recent rapid increases in primary school enrollment following the removal of primary school fees in three East African countries (Kenya, Tanzania and Uganda) suggest that monetary incentives are likely to have strong effects in that region (see Stasavage, 2005; IMF, 2003; World Bank 2004b).

Providing direct monetary incentives to enroll in primary school is only one possible route for attaining UPC. Other effective policies may be available. For example, in countries where children have high levels of intestinal parasites, provision of deworming medicines can raise enrollment rates, at least to some extent, for a very low cost. More generally, primary schools must be effective at providing skills, and the return to those skills must be high enough for parents to continue to enroll their children. Ensuring that schools effectively teach skills is the responsibility of ministries of education, while ensuring that skills are rewarded in the labor market is a general task of economic development policy. Just as little is known about why some children are not enrolled in school, little is known about how education policies affect learning (see Glewwe, 2002, and Glewwe and Kremer, 2006).

In our view, the research done to date is inadequate to provide a plausible estimate of the cost of attaining UPC. More research is needed on education policies that persuade parents to enroll their children, and on policies that ensure that children learn valuable skills. Randomized trials are arguably the most convincing approach to assessing specific school policies, and donor agencies should encourage and support such evaluations. Given the concentration of the problem in Sub-Saharan Africa, most studies should be undertaken in those countries. Because the causes of non-enrollment are likely to vary across regions within a single country, separate studies may have to be done in each region where a large proportion of children are not completing primary school.

Once effective policies are found, it is usually simple to calculate the costs of implementing those policies. The data needed on expenditure are usually part of the cost of implementing the randomized evaluation, and in many cases, the cost per school does not change when the program is expanded to the national level. The main barrier to increasing the number of randomized evaluations is funding. Most economists would agree that the results from

such studies are public goods, which implies that some government agency or agencies should provide funding. International development agencies such as the World Bank and the United Nations are obvious sources for such funding. When those agencies, perhaps in concert with bilateral aid agencies, provide funds for a large number of randomized trials, a key step will have been taken toward calculating the cost of attaining universal primary completion, and ultimately toward attaining that goal itself.

# Appendix: Countries Used in the Analysis

| | Country | UPC Status | Income Level | Most Recent PCR | Most Recent (year) | PCR 2015 |
|---|---|---|---|---|---|---|
| **Sub-Saharan Africa** | | | | | | |
| 1 | Angola | seriously off track | low | — | — | — |
| 2 | Benin | off track | low | 39 | 1998 | 73 |
| 3 | Botswana | already achieved | middle | 102 | 1996 | 100 |
| 4 | Burkina Faso | seriously off track | low | 25 | 1998 | 38 |
| 5 | Burundi | seriously off track | low | 43 | 1998 | 37 |
| 6 | Cameroon | seriously off track | low | 43 | 1999 | 18 |
| 7 | Cape Verde | already achieved | middle | 117 | 1997 | 100 |
| 8 | Central African Rep. | seriously off track | low | 19 | 2000 | 6 |
| 9 | Chad | seriously off track | low | 19 | 2000 | 19 |
| 10 | Comoros | seriously off track | low | 33 | 1993 | 11 |
| 11 | Congo | seriously off track | low | 44 | 2000 | 19 |
| 12 | Cote D'Ivoire | seriously off track | low | 48 | 1999 | 55 |
| 13 | Congo, Democratic Rep. | seriously off track | low | 40 | 2000 | 28 |
| 14 | Equatorial Guinea | seriously off track | low | 46 | 1993 | — |
| 15 | Eritrea | off track | low | 35 | 1999 | 61 |
| 16 | Ethiopia | seriously off track | low | 24 | 1999 | 28 |
| 17 | Gabon | on track to achieve | middle | 80 | 1995 | 100 |
| 18 | Gambia | on track to achieve | low | 70 | 2000 | 100 |
| 19 | Ghana | off track | low | 64 | 1999 | 66 |
| 20 | Guinea | off track | low | 34 | 2000 | 61 |
| 21 | Guinea–Bissau | seriously off track | low | 31 | 2000 | 50 |
| 22 | Kenya | seriously off track | low | 58 | 1995 | 38 |
| 23 | Lesotho | off track | low | 69 | 1996 | 85 |
| 24 | Liberia | no data | low | — | — | — |
| 25 | Madagascar | seriously off track | low | 26 | 1998 | 9 |
| 26 | Malawi | on track to achieve | low | 50 | 1995 | 100 |
| 27 | Mali | off track | low | 23 | 1998 | 49 |
| 28 | Mauritania | off track | low | 46 | 1998 | 72 |
| 29 | Mauritius | already achieved | middle | 111 | 1997 | 100 |
| 30 | Mozambique | off track | low | 36 | 1998 | 49 |
| 31 | Namibia | on track to achieve | middle | 90 | 1997 | 100 |
| 32 | Niger | seriously off track | low | 20 | 1998 | 24 |
| 33 | Nigeria | off track | low | 67 | 2000 | 60 |
| 34 | Rwanda | seriously off track | low | 40 | 2000 | 49 |
| 35 | Sao Tome & Principe | off track | low | 84 | 2001 | — |
| 36 | Senegal | seriously off track | low | 41 | 2000 | 36 |
| 37 | Seychelles | no data | middle | — | — | — |
| 38 | Sierra Leone | seriously off track | low | 32 | 2000 | — |
| 39 | Somalia | no data | low | — | — | — |
| 40 | South Africa | already achieved | middle | 98 | 1995 | 100 |
| 41 | Sudan | seriously off track | low | 35 | 1996 | — |
| 42 | Swaziland | on track to achieve | middle | 81 | 1997 | 100 |
| 43 | Togo | on track to achieve | low | 63 | 1999 | 100 |
| 44 | Uganda | on track to achieve | low | 65 | 2001 | 98 |
| 45 | Tanzania | off track | low | 59 | 1997 | 88 |
| 46 | Zambia | seriously off track | low | 83 | 1995 | 43 |
| 47 | Zimbabwe | already achieved | low | 113 | 1997 | 100 |
| **East Asia and Pacific** | | | | | | |
| 1 | Cambodia | on track to achieve | low | 70 | 2001 | 100 |
| 2 | China | already achieved | middle | 108 | 1996 | 100 |
| 3 | Micronesia | no data | middle | — | — | — |
| 4 | Fiji | already achieved | middle | 95 | 1992 | 100 |
| 5 | Indonesia | off track | low | 91 | 2000 | 90 |
| 6 | Kiribati | no data | middle | — | — | — |

*PCR=Primary Completion Rate

| | Country | UPC Status | Income Level | Most Recent PCR | Most Recent (year) | PCR 2015 |
|---|---|---|---|---|---|---|
| 7 | Korea, Dem. Repub. | no data | low | — | — | — |
| 8 | Korea, Republic of | already achieved | middle | 96 | 2000 | 100 |
| 9 | Laos | on track to achieve | low | 69 | 2000 | 100 |
| 10 | Malaysia | off track | middle | 90 | 1994 | 85 |
| 11 | Marshall Islands | no data | middle | — | — | — |
| 12 | Mongolia | off track | low | 82 | 1998 | — |
| 13 | Myanmar | no data | low | — | — | — |
| 14 | Papua New Guinea | off track | low | 59 | 1995 | 83 |
| 15 | Philippines | on track to achieve | middle | 92 | 1996 | 100 |
| 16 | Palau | no data | middle | — | — | — |
| 17 | Samoa | already achieved | middle | 99 | 1997 | 100 |
| 18 | Solomon Islands | off track | low | 66 | 1994 | 71 |
| 19 | Thailand | off track | middle | 90 | 2000 | 86 |
| 20 | Tonga | no data | middle | — | — | — |
| 21 | Vanuatu | off track | middle | 86 | 1992 | 52 |
| 22 | Viet Nam | already achieved | low | 101 | 2001 | 100 |
| **Europe and Central Asia** | | | | | | |
| 1 | Albania | off track | middle | 89 | 1995 | 57 |
| 2 | Armenia | off track | low | 82 | 1996 | — |
| 3 | Azerbaijan | already achieved | low | 100 | 1998 | 100 |
| 4 | Belarus | off track | middle | 93 | 1996 | 74 |
| 5 | Bosnia & Herzegovina | on track to achieve | middle | 88 | 1999 | — |
| 6 | Bulgaria | on track to achieve | middle | 92 | 1996 | 98 |
| 7 | Croatia | already achieved | middle | 96 | 2001 | 100 |
| 8 | Czech Republic | already achieved | middle | 109 | 1995 | 100 |
| 9 | Estonia | off track | middle | 88 | 1995 | 55 |
| 10 | Georgia | off track | low | 82 | 1998 | — |
| 11 | Hungary | already achieved | middle | 102 | 1995 | 100 |
| 12 | Kazakhstan | no data | middle | — | — | — |
| 13 | Kyrgyzstan | no data | low | — | — | — |
| 14 | Latvia | on track to achieve | middle | 86 | 1996 | 100 |
| 15 | Lithuania | already achieved | middle | 95 | 1996 | 100 |
| 16 | Moldova | on track to achieve | low | 79 | 1999 | 100 |
| 17 | Poland | already achieved | middle | 96 | 1995 | 100 |
| 18 | Romania | already achieved | middle | 98 | 1996 | 100 |
| 19 | Russia | already achieved | middle | 96 | 2001 | 100 |
| 20 | Serbia & Montenegro | already achieved | middle | 96 | 2000 | 100 |
| 21 | Slovakia | already achieved | middle | 97 | 1996 | 100 |
| 22 | Tajikistan | off track | low | 77 | 1996 | — |
| 23 | Macedonia | no data | middle | 91 | 1996 | 100 |
| 24 | Turkmenistan | no data | low | — | — | — |
| 25 | Ukraine | on track to achieve | low | 94 | 2002 | — |
| 26 | Uzbekistan | no data | low | — | — | — |
| **Latin America and the Caribbean** | | | | | | |
| 1 | Antigua & Barbuda | already achieved | middle | 98 | 2000 | — |
| 2 | Argentina | already achieved | middle | 96 | 2000 | 100 |
| 3 | Belize | off track | middle | 82 | 1999 | 69 |
| 4 | Bolivia | on track to achieve | middle | 72 | 2000 | 98 |
| 5 | Brazil | on track to achieve | middle | 72 | 1999 | 100 |
| 6 | Chile | already achieved | middle | 99 | 2000 | 100 |
| 7 | Colombia | on track to achieve | middle | 85 | 2000 | 100 |
| 8 | Costa Rica | on track to achieve | middle | 89 | 2000 | 100 |
| 9 | Cuba | already achieved | middle | — | — | — |
| 10 | Dominica | already achieved | middle | 103 | 2000 | 100 |
| 11 | Dominican Republic | off track | middle | 62 | 2000 | — |
| 12 | Ecuador | already achieved | middle | 96 | 1999 | 100 |
| 13 | El Salvador | on track to achieve | middle | 80 | 2000 | 100 |
| 14 | Grenada | already achieved | middle | 106 | 2001 | 100 |

| | Country | UPC Status | Income Level | Most Recent PCR | (year) | PCR 2015 |
|---|---|---|---|---|---|---|
| 15 | Guatemala | off track | middle | 52 | 2000 | 67 |
| 16 | Guyana | off track | middle | 89 | 2000 | 85 |
| 17 | Haiti | off track | low | 40 | 1997 | 71 |
| 18 | Honduras | off track | middle | 67 | 2000 | 69 |
| 19 | Jamaica | on track to achieve | middle | 94 | 2000 | 100 |
| 20 | Mexico | already achieved | middle | 100 | 2000 | 100 |
| 21 | Nicaragua | on track to achieve | low | 65 | 2000 | 95 |
| 22 | Panama | on track to achieve | middle | 94 | 2000 | 100 |
| 23 | Paraguay | on track to achieve | middle | 78 | 2000 | 98 |
| 24 | Peru | already achieved | middle | 98 | 2000 | 100 |
| 25 | St. Kitts & Nevis | already achieved | middle | 110 | 2001 | 100 |
| 26 | St. Lucia | already achieved | middle | 106 | 2001 | 100 |
| 27 | St. Vincent & Grenadines | off track | middle | 84 | 2001 | — |
| 28 | Suriname | no data | middle | — | — | — |
| 29 | Trinidad & Tobago | off track | middle | 94 | 2000 | 94 |
| 30 | Uruguay | already achieved | middle | 98 | 2000 | 100 |
| 31 | Venezuela | off track | middle | 78 | 1999 | 55 |
| **Middle East & North Africa** | | | | | | |
| 1 | Algeria | on track to achieve | middle | 91 | 1996 | 100 |
| 2 | Bahrain | off track | middle | 91 | 1996 | 59 |
| 3 | Djibouti | seriously off track | middle | 30 | 1999 | 26 |
| 4 | Egypt | already achieved | middle | 99 | 1996 | 100 |
| 5 | Iran | off track | middle | 92 | 1996 | 86 |
| 6 | Iraq | seriously off track | middle | 57 | 1995 | 33 |
| 7 | Jordan | already achieved | middle | 104 | 2000 | 100 |
| 8 | Lebanon | off track | middle | 70 | 1996 | — |
| 9 | Libya | no data | middle | — | — | — |
| 10 | Morocco | off track | middle | 55 | 1996 | 85 |
| 11 | Oman | on track to achieve | middle | 76 | 1996 | 100 |
| 12 | Palestine | no data | middle | — | — | — |
| 13 | Saudi Arabia | on track to achieve | middle | 69 | 1996 | 98 |
| 14 | Syria | off track | middle | 90 | 1996 | 65 |
| 15 | Tunisia | on track to achieve | middle | 91 | 1996 | 100 |
| 16 | Turkey | on track to achieve | middle | — | — | — |
| 17 | Yemen | off track | low | 58 | 2000 | — |
| **South Asia** | | | | | | |
| 1 | Afghanistan | seriously off track | low | 8 | 1999 | 0 |
| 2 | Bangladesh | on track to achieve | low | 70 | 2000 | 100 |
| 3 | Bhutan | off track | low | 59 | 2001 | — |
| 4 | India | off track | low | 76 | 1999 | 90 |
| 5 | Maldives | already achieved | middle | 112 | 1993 | 100 |
| 6 | Nepal | off track | low | 65 | 2000 | 85 |
| 7 | Pakistan | off track | low | 59 | 2000 | 79 |
| 8 | Sri Lanka | already achieved | middle | 111 | 2001 | 100 |

Source: Bruns et al (2003).

Note:
'already achieved' denotes countries that have already achieved UPC of 95 percent or higher;
'on track to achieve' denotes countries that will achieve UPC of 100 percent by 2015;
'off track' denotes countries whose projected UPC for 2015 is between 50 percent and 100 percent;
'seriously off track' denotes countries whose projected UPC for 2015 is less than 50 percent;
'no data' denotes countries that have not yet achieved UPC and for which no data are available to make projections to 2015.

The 151 countries in this table differ in the following ways from the 155 in the World Bank report by Bruns et al. (2003). First, this list includes Suriname, which appears to have been mistakenly omitted in the World Bank study. Second, this list excludes four high income countries that were included in the World Bank report: Kuwait, Qatar, Slovenia and the United Arab Emirates. Third, this list excludes East Timor, due to its small size and lack of data. Fourth, low income and middle income in this list is defined according to the World Bank's definition, namely countries with annual income per capita below or above $755, respectively, while the World Bank study defines it in terms of whether or not loans are received from the World Bank's source of funds for low income countries, the International Development Association (IDA).

# References


Brossard, Mathieu, and Luc-Charles Gacougnolle. 2001. "Financing Primary Education for All: Yesterday, Today and Tomorrow." Paris: United Nations Educational, Scientific and Cultural Organization.

Bruns, Barbara, Alain Mingat, and Ramahatra Rakotomalala. 2003. *Achieving Universal Primary Education by 2015: A Chance for Every Child*. Washington, DC: The World Bank.

Delamonica, Enrique, Santosh Mehrotra, and Jan Vandemoortele. 2001. "Is EFA Affordable? Estimating the Global Minimum Cost of Education for All." Innocenti Working Paper 87. Florence, Italy: UNICEF.

Devarajan, Shantayana, Margaret Miller, and Eric Swanson. 2002. "Goals for Development: History, Prospects and Costs." Policy Research Working Paper No. 2819. Washington, DC: The World Bank.

Duflo, Esther. 2001. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment." *American Economic Review* 91(4): 795–813.

Filmer, Deon. 2001. "'Costing' the Goal of Universal Primary Enrollment by 2015: Back of the (Big) Envelope Calculations." Washington, DC: The World Bank.

Glewwe, Paul. 2002. "Schools and Skills in Developing Countries: Education Policies and Socioeconomic Outcomes." *Journal of Economic Literature* 40 (2): 436–482.

Glewwe, Paul, and Michael Kremer. 2006. "Schools, Teachers and Education Outcomes in Developing Countries." In *Handbook of the Economics of Education*, ed. E. Hanushek and F. Welch. Amsterdam: North Holland.

Glewwe, Paul, and Pedro Olinto. 2004. "Evaluating the Impact of Conditional Cash Transfers on Schooling: An Experimental Analysis of Honduras' PRAF Program." University of Minnesota and International Food Policy Research Institute. Mimeo.

Hanushek, Eric. 1995. "Interpreting Recent Research on Schooling in Developing Countries." *World Bank Research Observer* 10(2): 227–246.

International Monetary Fund (IMF). 2003. "Tanzania: Joint Staff Assessment of the Poverty Reduction Strategy Paper." IMF Country Report No. 03/306. Washington, DC: The International Monetary Fund.

Maluccio, John, and Rafael Flores. 2004. "Impact Evaluation of a Conditional Cash Transfer Program: The Nicaraguan *Red de Protección Social*." Food Consumption and Nutrition Division discussion paper. Washington DC: International Food Policy Research Institute.

Miguel, Ted, and Michael Kremer. 2004. "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities." *Econometrica* 72(1): 159–217.

Morley, Samuel, and David Coady. 2003. *From Social Assistance to Social Development: Targeted Education Subsidies in Developing Countries*. Washington, DC: Center for Global Development and International Food Policy Research Institute.

PROBE Team. 1999. *Public Report on Basic Education in India*. New Delhi: Oxford University Press.

Stasavage, David. 2005. "On the Role of Democracy in Uganda's Move to Universal Primary Education." *Journal of Modern African Studies* 43 (1): 53–73.

World Bank. 2002. *World Development Indicators 2002*. Washington, DC: The World Bank.

——. 2004a. "Books, Buildings and Learning Outcomes: An Impact Evaluation of World Bank Support to Basic Education in Ghana." Washington, DC: The World Bank.

——. 2004b. "Kenya: Strengthening the Foundation of Education and Training in Kenya." Washington, DC: The World Bank.

CHAPTER 2

# The Cost of Providing Universal Secondary Education in Developing Countries

MELISSA BINDER

This paper provides estimates of the additional expense that developing-country governments would incur in supplying enough places in secondary schools to accommodate all children of secondary school age. Under current repetition rates and cost structures, annual costs are estimated to be $34 billion if expansion is to occur over a 15-year horizon, and $28 billion over a 25-year horizon. The estimated expenditures fall to $32 and $24 billion, respectively, under a scenario in which school systems reduce repetition rates. A further reduction in cost, to $27 and $22 billion per year, occurs when the estimates are based on the experience of "best practice" countries that have higher enrollments than predicted by their income and region. The estimates in this paper do not represent the total cost of achieving universal secondary education, as they do not include the often-considerable expense to families of sending children to school, nor do they consider the additional expense to governments of achieving universal primary education. Nevertheless, this estimation of the expense of providing the necessary secondary school places is an essential starting point for understanding the cost of universal secondary education.

Low levels of education around the world contribute to continued poverty for millions of people. Nearly 400 million children in developing countries between the ages of 12 and 17 do not attend secondary school. According to an extensive literature, these children will be less economically productive and will have worse health outcomes and higher fertility rates than those with more education.[1] There is some evidence that their low levels of education will inhibit economic growth at the national level for the countries in which they live.[2] In short, low levels of education have high costs, in terms of foregone opportunity and well being.

1. For more on the economic returns to schooling, see Psacharopoulos (1994). For a review of health and fertility effects of education, see Hannum and Buchmann (2003).

2. Hannum and Buchmann (2003) review this literature.

Since the 1960s, access to primary education worldwide has increased dramatically. As of the year 2000, 96 of 112 reporting low-income countries had primary gross enrollment rates that exceeded 75 percent. Access to secondary schooling, unfortunately, has not followed suit. Of these same countries, only 39 reported similarly high gross enrollment rates for secondary education. Moreover, there is evidence that the expansion of secondary schooling has stagnated in recent years (Bloom, 2006; Lewin and Caillods, 2001; Binder and Woodruff, 2002; IDB, 1998), perhaps in part because of a decline in development aid for secondary schooling during the 1980s.[3]

Given the central role of secondary education in alleviating poverty and promoting economic growth, it is vital that we understand the barriers to its expansion so that they can be overcome. This paper identifies the likely financial costs of supplying secondary school places to all children in developing countries. The supply-side analysis below includes the costs of teacher salaries, classrooms, materials, and administration.

The paper does not consider costs borne by families in sending their children to school. The higher direct costs of secondary schooling in comparison to primary schooling and, even more important, the higher opportunity costs of sending older children to school instead of to work pose significant barriers to enrollment. However, systematic cross-country data on these costs are not available. Estimating the direct costs borne by families requires data on school fees and on the costs of transportation, books, and other school supplies where these are not provided by schools. For some countries, these data are available from consumer-expenditure surveys; however, locating these data was beyond the scope of this project, and the number of countries for which these data are complete would likely be small. Estimating opportunity costs requires wage data disaggregated by age and gender. These are probably available for the dozens of developing countries that collect labor-force information in household surveys, but again, the enormity of the task precludes making use of them in this paper. In both cases, the poorest countries are unlikely to collect these data. Given these limitations, calculating demand-side costs might best be served by focusing on comprehensive case studies for a small subset of countries.

Finally, this paper does not consider the additional expense to governments of achieving universal primary education. The estimates provided here therefore cover only part—albeit an important part—of the expense that the achievement of universal secondary education will require.

## THE UNIT COST METHOD

I adopt the unit cost method typical of research that assesses the supply costs of educational expansion at the primary level (Delamonica et al., 2001; Devarajan et al., 2002). Under this method, the researcher determines the per

3. Spending for secondary education has recovered since the early 1990s (Bloom, 2006; Lewin and Caillods, 2001: 4).

student cost of the current educational system and then multiplies this unit cost by the number of children not enrolled in school. Although a straightforward calculation, compiling unit costs is complicated considerably by lack of data for many countries. The World Development Indicators (WDI) 2003 data set shows current unit costs for secondary schooling as a percent of per capita income in 1999 for only 60 of the 144 developing countries in this paper's sample population. The World Education Indicators (WEI) program of the Organisation for Economic Co-operation and Development (OECD) and the UNESCO Institute for Statistics (UNESCO-UIS) provides 1999 unit costs for 15 of the developing countries it tracks, and reports a mean country unit cost of $1127 in purchasing power parity (PPP) US dollars (OECD/UNESCO-UIS, 2003: Table 9). Although the WEI countries with unit cost data are home to 53 percent of the secondary school age population (those 12–17 years old) in developing countries, they represent only 10 percent of developing countries and include only three low-income countries (out of a total of 66) and only one African country. Moreover, providing costs in PPP terms makes it difficult to assess the contribution of external donors. As shown below, the costs appear to be much lower in standard currency-converted dollars, as well as for poorer countries.

In this study, I estimate unit costs according to the following procedure. First, I determine the total public expenditure for secondary schooling. Second, I divide by the number of students, to determine the unit cost. Third, I multiply the unit cost by the number of children not enrolled in school to determine the additional of cost of schooling these students. Industrialized countries average 90 percent enrollment of secondary school age children; this paper uses the 90 percent enrollment rate as the goal for achieving "universal" secondary education.[4]

The primary data source for this analysis is the WDI; most of the calculations below derive from data for 1998–2000. For some variables, I make use of UNESCO-UIS statistics. WDI provides figures for total public expenditure—which combines current and capital expenditures—on education as a percent of GDP, and UNESCO provides figures for spending on secondary schooling as a percent of total public expenditure on education. The product of these figures is public expenditure on secondary education as a percent of GDP, which I multiply by a country's GDP in constant 1995 U.S. dollars (using current exchange rates) to get current total spending in U.S. dollars. I then use the GDP deflator to convert these figures to 2002 dollars. This paper uses the exchange rate conversion rather than the PPP conversion, as stated earlier, because of a greater interest in knowing the dollar amount of providing school spaces. If the dollar goes further in many countries, then this is so much the better.

WDI reports the gross enrollment rate (GER) in secondary education for 118 developing countries, and the net enrollment rate (NER) in secondary

4. The United States, with an 88 percent enrollment rate, falls short of universal secondary education under this definition.

education for 92 of these countries. I use the regional mean of the NER-to-GER ratio to estimate NERs for countries that only report the GER. The GER is the number of students enrolled in secondary education programs (as defined by UNESCO) as a proportion of the population who are of the appropriate age. For most countries, secondary education covers children between the ages of 12 and 17, and this is the population used in the calculations below. The NER is the number of enrolled secondary education students of the appropriate age group as a proportion of the total population of age-appropriate children. Again, this paper uses the 12–17 age group. The GER includes students who are outside the expected school-age range due to grade repetition or entrance into the school system older or younger than the standard entry age. It typically exceeds the NER. Although the GER does not indicate how many children of the appropriate age are enrolled, it does provide a measure of the capacity of the school system to absorb these children and is therefore an important indicator.

Multiplying the GER by the population of 12–17 year olds yields the number of students enrolled, and this is the number used to calculate per student costs. Multiplying the NER by the 12–17 year-old population and subtracting this number from the target of 90 percent of the 12–17 year-old population yields the number of school-age children who would need to enroll to achieve a 90 percent enrollment rate. I calculate the total additional cost of providing schooling by multiplying unit costs by the number of children who need to enroll to reach the target enrollment rate. Lines 1–5 in Table 4 of the Appendix delineate these steps.

This method provides a useful starting point for estimating the resources required to achieve universal secondary education. Some caveats apply, however. First, in many countries with low secondary school enrollment, expanding enrollment will involve the construction of new classrooms and schools. The unit cost calculations in this paper combine capital and recurring costs, and thus may overestimate the costs in a country experiencing rapid increases in schooling access, because future capital costs will be lower. Likewise, it may underestimate the costs in a country that is not increasing access significantly. Lewin and Caillods (2001) point out that many African countries have barely kept up with demand for secondary schooling—the transition rate from primary to secondary schooling was stable, at least in the 1990s. This does indicate that some expansion occurred as the number of primary graduates increased; however, the expansion required to achieve universal access will likely incur higher capital costs than those indicated in unit costs based on current capital outlays.

One way to estimate these costs would be to look at the experiences of countries that have increased secondary enrollments over a period of time. Unfortunately, time-series data that report capital and recurrent education spending are not consistently available. Nor is it possible to make use of the literature on educational cost functions (Jimenez, 1986; Tsang, 1994) because the information gleaned from the few developing countries for which esti-

mates are available "may be almost totally irrelevant in a different education system" (Verry, 1987: 400). A final possibility is to use an average or preferred classroom size and country or best-practice construction costs to assess the need for and cost of more classrooms (Colclough with Lewin, 1993; Bruns et al., 2003). It was not possible, however, to locate data on construction costs for secondary school classrooms for use in this analysis.

Another set of concerns is presented by the distinction between lower- and upper-secondary schooling. Although WDI provides enrollment data for some countries by secondary schooling level, there are no corresponding expenditure data. The unit costs calculated in this paper therefore mix the two levels, likely overestimating the costs of lower-secondary and underestimating the costs of upper-secondary education. The WEI unit cost data report lower- and upper-secondary costs separately for ten countries. On average, country unit costs for upper secondary exceed lower-secondary costs by 39 percent. This average is skewed by the more than 3.5 times difference between lower- and upper-secondary costs in China. The average differential without China is 10 percent. Although not necessarily representative, the data suggest that it is feasible to assume that countries can offer both levels of secondary schooling at close to the same unit cost. Countries that currently have large discrepancies in costs between these levels could presumably expand secondary education at a lower average cost. Using the average over both levels for these countries would overestimate expansion costs. Nevertheless, because implementing new institutional structures to reduce upper-secondary costs will likely be costly, computing a unit cost for both levels combined results in a figure that is probably not terribly far from the mark.

Finally, the contribution of private-sector education to total educational coverage is likely important in some countries. Ideally, one would calculate unit costs by dividing public spending on secondary schooling by the number of public-school students. Unfortunately, even if the number of students in public institutions is known, some countries provide funding to private schools (Lewin and Caillods, 2001). Excluding private students in these cases will result in an overestimate of unit costs, while including them in countries with no subsidies will lead to an underestimate. Data on private enrollment[5] are available for only 70 countries in the sample. Calculating unit costs over public-school students only in this sample gives a unit cost estimate 7.5 percent higher than the cost calculated over all students. Because limiting the spread of costs to students in public institutions overestimates costs (i.e., some public spending supports private-school students), the actual difference may be smaller. Nevertheless, an increase of 7.5 percent in the estimates of this study would roughly account for the higher costs masked by using total enrollments in the unit cost calculations.

5. Available through the World Bank EDSTATS system: http://www1.worldbank.org/education/edstats.

## THE STUDY POPULATION

This paper provides estimates for the 144 developing countries on the July 2003 World Bank list of countries for which UNESCO also provides population figures for children ages 12–17. Table 1 in the Appendix arranges these countries by their World Bank classification for region and income group. As Table 1 shows, estimates for 69 countries (and 67 percent of the 12–17 year-old developing country population) are based on complete country data; estimates for 61 countries (30 percent of the target population) use at least some imputed data in the cost calculations. The remaining 14 countries (3 percent of the target population) had inadequate data for cost calculations and simply receive the regional mean unit cost.

The most common missing variable was percent of total education spending spent at the secondary level. I calculate unit costs for these countries by imputing missing values from a neighboring country with similar income, population, and enrollment rates. Because so few countries in Europe reported complete education data, I rely on education finance data prior to 1998 for some imputations. I am reluctant to do this more generally, because the UNESCO classification of secondary school programs changed between 1997 and 1998. Costs have not been imputed for the 14 countries with no enrollment rates or GDP data, although they have been included in global cost estimates by using regional averages.

Table 2 provides summary statistics by region and income for the sample as a whole, and for the countries that participated in the 1999 Trends in International Mathematics and Science Study (TIMSS), a project organized by the International Association for the Evaluation of Educational Achievement and sponsored by the United States, the World Bank, and the United Nations, among others. Although only 20 of the study-population countries participated in TIMSS, I use the reported test scores as a direct measure of the effectiveness of an educational system. Table 2 in the Appendix provides a list of TIMSS countries.

Table 2 shows that, within regions, net enrollment rates rise with income. The rates are similar for lower- and upper-middle-income groups across regions, although the region of Europe and Central Asia enjoys particularly high rates and Sub-Saharan Africa has particularly low rates. The lower-middle-income group exhibits considerable variation among regions, with Sub-Saharan Africa and South Asia at the low end. Large standard deviations for most cells indicate that there is a wide range of outcomes, even for countries in the same region and income group.

Unit costs are also quite similar across regions for low-income countries. Note that at the secondary level, unit costs in Sub-Saharan Africa are typical of other regions, in contrast to the primary level, where Africa's costs appear to be considerably higher (Colclough with Lewin, 1993). Costs in the middle-income countries vary more across regions, especially for the upper-middle-income group. The Middle East and North Africa region has particularly high costs—more than double the mean costs estimated for Sub-Saharan

**Table 1:** Data Available for Calculating Unit Costs

| | | Children 12–17 Years of Age in 2000 | | | |
|---|---|---|---|---|---|
| | | All | | Not enrolled | |
| | Number of Countries | Number in millions | Percent | Number in millions | Percent |
| Complete data in at least one year between 1998 and 2000 | 60 | 405.5 | 64.5 | 198.2 | 60.9 |
| Complete data in different years between 1998 and 2000 | 9 | 16.1 | 2.6 | 8.9 | 2.7 |
| Imputed based on partial data | 61 | 187.9 | 29.9 | 107.5 | 33.1 |
| Insufficient data to impute | 14 | 19.0 | 3.0 | est. 10.6 | 3.3 |
| TOTAL | 144 | 628.5 | | 325.2 | |

Source: Author's calculations based on World Development Indicators and UNESCO-UIS and Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2002 Revision,* and *World Urbanization Prospects: The 2001 Revision.* Available online: http://esa.un.org/unpp.

Note: Population figures for this age group are provided directly by the UN Population Division (see above). The estimate of those not enrolled was derived as follows. First, I estimated the number of children 12–17 who were enrolled in school by multiplying the total population in this age group by the most recently available net enrollment rate between 1998 and 2000 for the 96 countries reporting this statistic directly. I imputed the net enrollment rate for an additional 35 countries that reported the gross enrollment rate, using the predicted value from a regression of the ratio of the net to gross enrollment rate on per capita income, 12–17 year-old population, spending on secondary schooling as a percent of GDP, and five regional dummy variables. For 13 countries with no enrollment data, I used the average regional enrollment rate. Second, I subtracted the estimated number enrolled from the total 12–17 population.

Africa and Latin America. Again, large standard deviations suggest considerable variation within income groups and regions.

The mean population-weighted NER is 37 percent for children living in low-income countries, 58 percent in lower-middle-income countries, and 69 percent in upper-middle-income countries. The mean weighted unit cost is $125 for low-income countries, compared with $227 and $912, for lower- and upper-middle-income countries, respectively. These figures suggest that the educational expansion needed to achieve universal access will occur primarily in poorer countries where costs are lower. The figures also indicate that there is an enormous increase in costs moving from lower-middle-income to upper-middle-income countries.

Of the twenty TIMSS countries listed in Appendix Table 2, eleven are in Europe, and all but two are middle income. As noted above, Europe has the highest enrollment rates and fairly typical, although not lower than average, unit costs. The over-representation of European countries in the TIMSS sample may bias the analysis of test-score performance in this study. Table 2 shows that enrollment rates and unit costs are higher for TIMMS countries

**Table 2:** Summary Statistics by Region, TIMSS Participation, and Income Group

| | | | | | | | ALL | | TIMSS | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SSA | SA | EA&P | ME&NA | LA&C | E&CA | Not weighted | Weighted | Not weighted | Weighted |
| **Number of countries** | | | | | | | | | | |
| Total | 46 | 8 | 19 | 16 | 28 | 27 | 144 | | 20 | |
| Low income | 39 | 6 | 10 | 1 | 2 | 8 | 66 | | 2 | |
| Lower-middle income | 4 | 2 | 8 | 10 | 15 | 11 | 50 | | 12 | |
| Upper-middle income | 3 | — | 1 | 5 | 11 | 8 | 28 | | 6 | |
| **Population shares** | | | | | | | | | | |
| Total (% of developing country population 12–17 years of age) | 14.8 | 27.8 | 32.1 | 7.1 | 10.2 | 8.0 | 100 | | 15.6 | |
| Low income (% of region or TIMSS) | 92.6 | 98.8 | 24.3 | 6.1 | 3.2 | 24.1 | | | 27.3 | |
| Lower-middle income (% of region or TIMSS) | 6.8 | 1.2 | 74.4 | 84.1 | 27.9 | 62.2 | | | 67.3 | |
| Upper-middle income (% of region or TIMSS) | 0.6 | — | 1.3 | 9.9 | 69.0 | 13.7 | | | 5.4 | |
| **Net enrollment rates** | | | | | | | | | | |
| Total | 23.1 (15.9) | 42.8 (15.3) | 51.4 (25.8) | 59.2 (17.9) | 60.0 (16.0) | 79.5 (9.4) | 49.5 (26.8) | 48.2 (19.0) | 70.0 (15.3) | 59.8 (13.8) |
| Low income | 17.4 (8.6) | 39.5 (11.5) | 37.2 (17.2) | 37.0 (.) | 35.5 (.) | 75.9 (9.8) | 30.1 (22.5) | 37.1 (18.0) | 57.9 (14.6) | 47.9 (4.0) |
| Lower-middle income | 47.8 (8.7) | 49.4 (25.4) | 64.9 (27.9) | 59.1 (19.6) | 54.9 (15.9) | 78.4 (10.1) | 61.6 (19.8) | 57.7 (11.0) | 66.9 (16.1) | 63.3 (13.5) |
| Upper-middle income | 59.8 (12.6) | — | 70.2 (.) | 64.9 (12.3) | 68.3 (11.8) | 84.6 (6.6) | 71.8 (13.2) | 68.8 (10.9) | 80.4 (8.1) | 76.8 (8.7) |
| **Unit costs in constant 2002 dollars** | | | | | | | | | | |
| Total | 202 (222) | 85 (37) | 336 (455) | 917 (1219) | 561 (490) | 521 (510) | 421 (574) | 240 (358) | 661 (509) | 435 (330) |
| Low income | 128 (87) | 86 (42) | 136 (139) | 249 (.) | 122 (142) | 125 (72) | 128 (90.1) | 125 (65) | 148 (158) | 255 (43) |
| Lower-middle income | 417 (311) | 82 (.) | 382 (470) | 369 (291) | 325 (249) | 307 (168) | 342 (284) | 227 (194) | 426 (244) | 429 (252) |
| Upper-middle income | 820 (82) | — | 1417 (.) | 2180 (1634) | 919 (522) | 1157 (394) | 1183 (809) | 912 (815) | 1302 (343) | 1415 (255) |

Source: WDI; UNESCO-UIS. Unit costs based on author's calculations.

Note: Standard deviations in parentheses. World regions for this and subsequent charts are Sub-Saharan Africa, South Asia, East Asia and Pacific, Middle East and North Africa, Latin America and the Caribbean, Europe and Central Asia.

than for the sample as a whole. Analysis using t-tests indicates that the differences are statistically significant, although not for unit costs compared within income groups, nor for the NER compared within the middle-income group. Nevertheless, the TIMSS sample as a whole clearly over-represents middle-income countries, and includes low-income and upper-middle-income countries with higher-than-average enrollments. Inferences from the TIMSS data will therefore be somewhat limited.

## EDUCATION FINANCE, SERVICE DELIVERY, AND SECONDARY SCHOOLING OUTCOMES

Another important question remains: What are the appropriate unit costs to use in estimating the financial resources needed to achieve universal secondary education in developing countries? In the expansion of an educational system, it is relevant to ask whether we want to provide "more of the same" quality or type of education, or whether the system needs reform. This paper explores whether countries with better schooling outcomes vary systematically from poorly performing countries in education finance and service delivery.[6]

Ideally, a study would use indicators of educational outcomes to identify countries that provide a high quality education to a high proportion of the age-appropriate population. As might be expected, measures of the quantity side of a system's performance (i.e., enrollment rates) are much more readily available than are measures of the quality side (i.e., test scores or literacy rates). In some sense, however, high enrollment rates do reflect quality—they indicate that a country has been relatively successful not only at creating more schooling places, but also at generating demand for those places. This analysis uses the net enrollment rate to measure quality (high gross enrollment rates alone, which often reflect high repetition rates, are not necessarily a desirable outcome). Performance quality is measured more directly using TIMSS scores. High-performing countries are identified by their outcomes relative to their incomes because, as demonstrated below, income is very closely associated with both net enrollment rates and TIMSS scores.

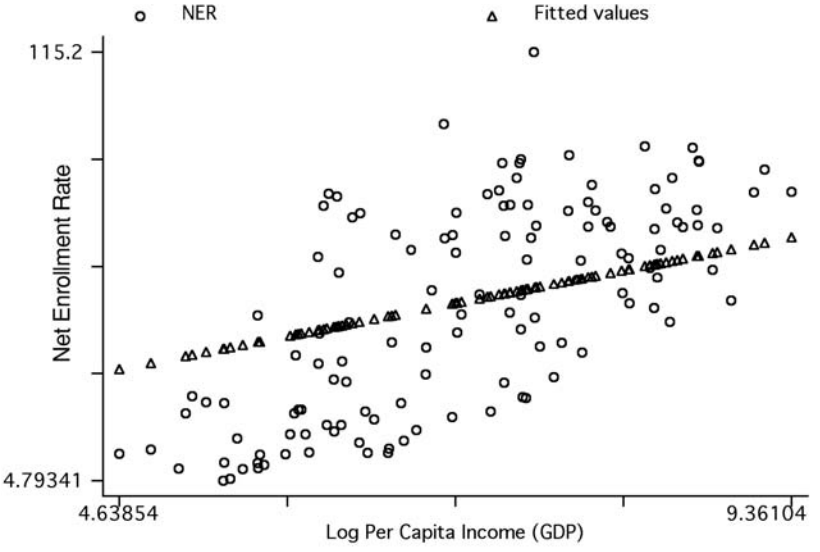
Figure 1 illustrates the high positive correlation between per capita income (here illustrated as log per capita income) and net enrollment rates in developing countries. The calculations[7] show that income alone accounts for 87 percent of the total variation of net enrollment rates. Adding region interactions raises this figure to 93 percent. Table 2 in the Appendix lists the countries that perform better than would be predicted by their per capita income and by their income level for their region.[8]

6. This approach is similar to that used by Bruns et al. (2003) for primary education.

7. Calculations used ordinary least squares (OLS) estimates of the effect of log per capita income on enrollment rates.

8. Predictions of performance by income level are made according to a regression of net enrollment rates on log per capita income. Predictions by income and region are made according to a regression of net enrollment rates on log per capita income interacted with region.

**Figure 1:** NER, Predicted NER, and Log Per Capita GDP



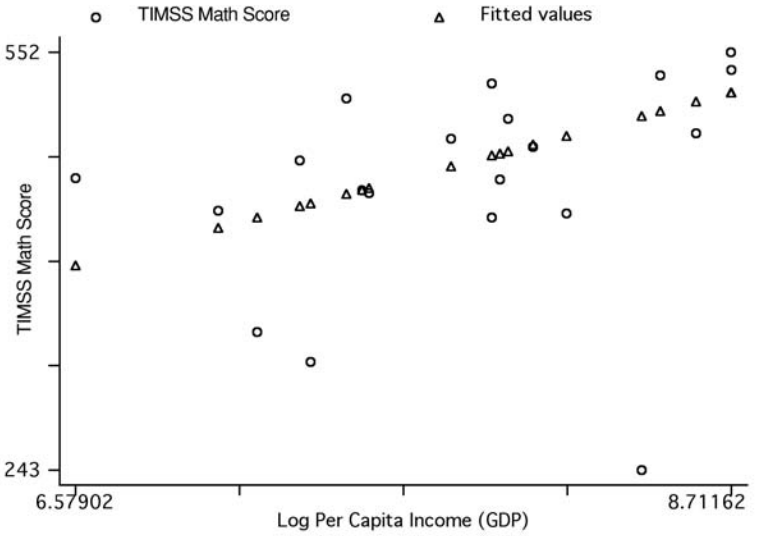

Source: Author's calculations based on enrollment rates and per capita income reported in the World Development Indicators.

Figure 2 shows that TIMSS scores are also highly correlated with income. The regression line shown excludes the outlier (South Africa, which has a test score below 245); log income explains 97 percent of the sample variation in test scores, even when South Africa is included. As Table 3 in the Appendix shows, all but one of the countries considered high performing under the TIMSS measure are in Europe. Moreover, six of the low-performing TIMSS countries are considered high performing under the NER measure. This provides further evidence that the TIMSS sample over-represents the better-performing countries.

Table 3 presents enrollment rates, education finance, and service delivery means for high- and low-performing countries under three performance criteria: 1) countries that have higher NER than predicted by income, 2) countries that have higher NER than predicted by income within regions, and 3) countries that have higher TIMSS scores than predicted by income. Statistically significant differences[9] appear in bold. Under both NER criteria, high-performing countries have significantly higher gross and net enrollment rates. The differences are more pronounced for high-performing countries relative to income alone, reflecting the exceptional performance of European countries in all income groups; when countries are compared within regions, the differences are somewhat attenuated, but still large. High-performing countries devote larger GDP shares to education under the NER criteria, but are not different from low-performing countries in the share of the education budget directed toward secondary schooling.

9. Significance is determined by t-tests.

**Figure 2:** TIMSS Math Score, Predicted Score, and Log Per Capita GDP




Source: Author's calculations based on test scores from the 1999 Trends in International Mathematics and Science Study (TIMSS) and per capita income reported in the World Development Indicators.

Note: Predictions based on a regression model that uses region and income interactions.

Unit costs as a percent of per capita income are significantly lower under the NER measures, although absolute unit costs are significantly higher for high performers relative to income alone. Better-performing countries under the NER criteria also have higher per capita income, even though they are judged relative to income. This explains why better performers can have higher unit costs and lower per capita unit costs at the same time. Indeed, this is clearly indicated in Figure 1, where a greater number of higher income countries appear above the regression line. Finally, among the service delivery measures, the repetition rate is 40–50 percent lower for countries with better-than-predicted NERs, and the primary-to-secondary transition rate is significantly higher, compared with countries that had worse-than-predicted enrollments. The number of pupils per teacher is lower for high-performing countries under the income-only criterion.

Because the countries in the TIMSS comparison appear to be a select lot, and a small representation at that, it is interesting that several significant differences emerge under the TIMSS measures. As was true under the NER measures, high-performing TIMSS countries have higher gross and net enrollment rates, higher transition rates between the primary and secondary levels, and considerably lower repetition rates. Similar to outcomes under the NER criterion relative to income only (criterion 1), high-performing TIMSS countries have significantly lower pupil-to-teacher ratios. Unit costs, however, are not significantly different among the TIMSS countries, nor is the GDP share dedicated to education. Unlike better-performing countries under the NER crite-

**Table 3:** Education Finance and Service Variables for Countries with Better and Worse Net Enrollment Rates Relative to Income and Region, and Better and Worse 1999 TIMSS Scores Relative to Income

| | Net enrollment rates | | | | | | TIMSS | | |
|---|---|---|---|---|---|---|---|---|---|
| | Performance relative to income | | | Performance relative to income X region | | | Performance relative to income | | |
| | N | Better | Worse | N | Better | Worse | N | Better | Worse |
| GER | 92 | **83.9** | **39.1** | 92 | **74.2** | **46.5** | 20 | **85.1** | **74.5** |
| NER | 93 | **73.2** | **30.1** | 92 | **63.3** | **37.8** | 20 | **77.1** | **62.9** |
| Public expenditure on education (% GDP) | 80 | **4.8** | **4.0** | 79 | **4.8** | **4.0** | 20 | 5.1 | 4.6 |
| Spending on secondary schooling (% of total education spending) | 54 | 36.4 | 33.0 | 54 | 35.6 | 35.6 | 15 | **45.4** | **32.4** |
| Unit cost in 2002 U.S. dollars | 91 | **$632** | **$342** | 91 | $538 | $414 | 20 | $789 | $534 |
| Unit cost as % of per capita income | 91 | **17.8** | **29.6** | 91 | **19.1** | **29.2** | 20 | 23.3 | 18.8 |
| Per capita GDP | 93 | **$3315** | **$1318** | 92 | **$2873** | **$1705** | 20 | $3021 | $2888 |
| Transition rate from primary to secondary levels | 65 | **89.9** | **75.1** | 65 | **88.4** | **75.2** | 10 | **94.8** | **84.6** |
| % of teachers who are trained | 25 | 74.0 | 68.8 | 25 | 70.5 | 80.5 | 3 | NA | NA |
| Pupils per teacher | 67 | **16.8** | **24.1** | 66 | 20.8 | 19.5 | 12 | **12.9** | **23.4** |
| Repetition rate | 61 | **5.3** | **11.0** | 61 | **6.4** | **10.3** | 11 | **1.3** | **12.0** |

Source: WDI and UNESCO-UIS. Unit costs are author's calculations from these sources.

Note: Significant differences in bold font. Significance using one-tailed tests is at the 5 percent level except for public expenditure on education (GDP share) for net enrollment rate performance and transition rate for TIMSS performance, which are significant at the 10 percent level.

ria, better-performing TIMSS countries do devote higher shares of their education expenditure to secondary schooling. Finally, higher-income countries do not appear to have an advantage over lower-income countries under the TIMSS criterion, even when middle-income but very low performing South Africa is omitted from the comparison.

A consistent finding under all three performance criteria is that educational systems with successful secondary schooling outcomes have low repetition rates and high transition rates from the primary level. In some sense, these are, in and of themselves, measures of success. High-quality education implies that there will be little need for repetition and high demand for secondary places among primary school graduates. This begs the question of how countries can provide high-quality education; however, the answer requires more complete data than are currently available. It also appears that better-performing countries have a stronger financial commitment to education, as represented by the share of GDP spent on education, but it is difficult

to draw conclusions about the relationship between performance and the other two education finance indicators: spending on secondary schooling as a share of total education spending, and unit costs.

Table 4 investigates whether the association between performance and finance and service delivery variables varies by income. There do appear to be differences among income groups. In particular, within the low-income group, unit costs as a percent of per capita income are significantly lower, transition rates are significantly higher, and repetition rates are significantly lower for high-performing countries. A distinct pattern also emerges for secondary education spending as a share of total education expenditure: high performers among the low-income countries spend a larger share than low performers, while high performers among middle-income countries spend a smaller share than low performers. This pattern likely reflects the growing importance of post-secondary education expenditures as secondary completion rates rise. For low-income countries, the low share of total education expenditure spent on secondary schooling is likely an artifact of the much greater effort involved in achieving universal primary education.

Table 5 repeats the analyses of Tables 3 and 4, using statistical techniques that allow us to consider the joints effects of education finance variables on performance. I regress the residuals from regressions of the NER on income, and on income and region interactions on: 1) education spending in GDP, 2) secondary spending in educational expenditure, 3) the log of unit cost, and 4) the log of unit cost as a per cent of per capita income. Because few countries report all education finance variables, the sample is restricted to 52 countries; to include the service delivery variables would restrict the sample even more, so no more elaborate specification is made. For the countries included in the regression analysis, share of GDP in education spending is significantly associated with better outcomes. Performance relative to income improves with higher unit costs, but worsens with higher costs as a percent of per capita income. Performance relative to income and region does not depend on the level of unit costs, but does again worsen for countries with high unit costs as a percent of per capita income. Finally, the last three columns of Table 5 show results of an analysis similar to that in Table 4, where effects are allowed to vary by income group. Under this specification, which uses the income and region interactions residuals as the dependent variable, unit costs as a share of per capita income for lower-middle-income countries are the only unit cost measures significantly associated with NER performance.

These analyses do not provide evidence for a strong link between unit costs and performance, making it difficult to choose the "right" unit cost. One option is to use the lowest cost country of those in the high-performing group. This would presumably be the most efficient spending model. Given, however, that it may be difficult (and initially costly) to replicate the most efficient system even if such a system had identifiable elements, and that perhaps some of the very low estimated unit costs derive from measurement error, this analysis instead uses the median-cost country among the high performers. The median-cost country provides a spending level that yields good

**Table 4**: Education Finance and Service Variables for Countries with Better and Worse than Predicted Net Enrollment Rates Relative to Income and Region, by Income

| | Low income | | | Lower-middle income | | | Upper-middle income | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Better than predicted | Worse than predicted | N | Better than predicted | Worse than predicted | N | Better than average | Worse than average |
| GER | 38 | **48.9** | **29.6** | 30 | **79.6** | **58.6** | 24 | **88.0** | **79.0** |
| NER | 38 | **42.8** | **24.6** | 30 | **66.1** | **47.1** | 24 | **76.2** | **63.5** |
| Public expenditure on education (% GDP) | 32 | 4.1 | 3.5 | 24 | 4.9 | 4.0 | 23 | 5.2 | 5.3 |
| Spending on secondary schooling (% of total education spending) | 17 | **41.8** | **27.9** | 19 | **31.1** | **48.1** | 18 | **34.1** | **40.2** |
| Unit cost in 2002 U.S. dollars | 38 | $95 | $130 | 29 | $364 | $378 | 24 | $1102 | $1280 |
| Unit cost as % of per capita income | 38 | **23.4** | **33.6** | 29 | 16.1 | 23.2 | 24 | 19.3 | 23.5 |
| Transition rate from primary to secondary levels | 26 | **90.0** | **62.7** | 21 | 87.5 | 85.4 | 18 | 88.1 | 91.8 |
| Trained teachers | 9 | 68.1 | 74.5 | 8 | 70.7 | 86.5 | 0 | NA | NA |
| Pupils per teacher | 22 | 26.4 | 24.7 | 22 | **20.9** | **17.2** | 22 | 16.3 | 14.8 |
| Repetition rate | 22 | **7.1** | **13.9** | 21 | 6.5 | 6.7 | 18 | 5.8 | 6.8 |
| Per capita GDP | 38 | $386 | $23 | 92 | **$2150** | **$1678** | 24 | $5730 | $5158 |

Source: WDI and UNESCO-UIS. Unit costs are author's calculations from these sources.

Note: Significant differences in bold font. Significance using one-tailed tests is at the 5 percent level for all variables except spending on secondary schooling as a share of total education spending for low income and upper-middle-income countries, pupils per teacher for lower-middle-income countries, and GER for upper-middle-income countries, which are all significant at the 10 percent level.

results, does not require that countries be exemplary in efficiency, and avoids the possibility that the lowest-cost estimate is a mistake. I construct two of these best-practice, reasonable spending-level unit costs: one by income group and one by region and income group.

Notwithstanding this pragmatic decision, several countries apparently have generated excellent secondary schooling outcomes at very low costs. This suggests that it is possible to achieve universal secondary schooling with less money than even the most optimistic estimates presented here. In-depth case studies are necessary to assess how these low costs are achieved, and whether or not they can be replicated elsewhere.

Despite the uncertain statistical relationship between unit costs and enrollment outcomes, the foregoing analysis suggests a significant link between enrollment and the share of GDP devoted to public spending on education. This study therefore establishes goals for apportioning costs between

**Table 5**: Ordinary Least Squares Estimates of the Relationship between Education Finance Variables and Enrollment Rate Performance (measured as the residual from a regression of the NER on income and region) and Differences by Income Group

| | Basic specification | | Differences specification | | |
|---|---|---|---|---|---|
| | Dependent variable | | Dependent variation is residual from income and region interactions | | |
| | Residual from regression on income | Residual from regression on income and region interactions | Main effect | Differences | |
| | | | Low income | Lower-middle income | Upper-middle income |
| GDP share | 2.5** (1.2) | 2.2** (.9) | 2.5** (.9) | .8 (2.2) | 1.4 (4.0) |
| Secondary share | .5** (.2) | -.02 (.2) | .5** (.2) | -.7* (.4) | -.5 (.6) |
| Log unit cost | 7.5** (2.2) | 2.1 (1.6) | -4.8 (4.5) | 10.9 (8.5) | 13.5 (8.4) |
| Log of unit cost divided by per capita GDP | -16.9** (3.9) | -8.5** (2.8) | -1.3 (4.6) | -20.1** (9.9) | -17.3 (18.2) |
| $R^2$ | .43 | .27 | | .39 | |
| N | 52 | 52 | | 52 | |

Source: Author's calculations based on data from WDI and UNESCO-UIS.

Note: Models include a constant. Standard errors are in parentheses.
**Denotes estimate is significant at the 5 percent level.
*Denotes significance at the 10 percent level.

countries and external donors using best-practice GDP share as the baseline spending for a country. The analyses also indicate that low repetition rates are a feature of successful secondary-education systems. Although it is true that low repetition rates are likely the result of high-quality schooling rather than the cause, this study adopts a low-repetition scenario as a desirable feature when estimating costs. In addition to reflecting improved quality, low repetition rates also generate large cost savings, as described below.

## COST CALCULATIONS

The estimates, detailed below, of the amount of spending needed to provide enough school spaces to achieve universal secondary education in developing countries are based on a series of assumptions about unit costs, repetition rates, and time horizons. I consider three unit cost scenarios. The first scenario assumes that present estimated unit costs give a realistic idea of what educational expansion will cost in the future. In this scenario, countries are expected simply to provide more of the same. In the second and third scenarios, I assume that the creation of additional spaces alone does not guarantee a corresponding rise in demand, and that countries also need to boost demand

by investing in educational reform. As shown below, the median high-performing country achieves better outcomes at a lower per unit cost than the average country. This suggests that substantial cost savings may be possible if research can determine how some countries are able to do better with less.

Although it is beyond the scope of this study, as mentioned above, understanding cross-country differences in educational finance and outcomes is clearly a priority for future research. This study relies simply on the median unit cost of education in countries with higher-than-predicted—"best practice"—enrollment rates, thereby ascribing a reasonable (and clearly attainable) ideal unit cost also associated with better outcomes.[10] The median is derived for two groups of countries corresponding to the NER criteria developed in the previous section: high performers relative to income, and high performers relative to income and region.

I also consider two alternative absorption scenarios. In the first, repetition rates are unchanged and so new school spaces must be created for all new enrollees, with an allowance for repetition among the new students as well. Under this scenario, unit costs are first multiplied by the number of new students who need to be enrolled to achieve a given net enrollment rate and this number is inflated by the current repetition rate, here defined as the ratio of the gross to the net enrollment rate.[11] Although this seems reasonable, many school systems in developing countries have high repetition rates, with a sizable proportion of over-age students.[12] These school systems already provide more spaces for school-age children than the number of out-of-school children would suggest. A country that reduced or eliminated grade repetition while enrolling new school-age children would therefore incur lower additional costs, because some of the needed spaces would already be available. I therefore consider an absorption scenario in which reduced repetition releases spaces currently occupied by over-age students to new age-appropriate enrollees. The target repetition rate is 7 percent, the mean rate among high-performing low-income countries. I assume no change in the repetition rate for countries already below this target.[13]

10. Using the student-weighted mean cost for high-performing countries results in costs about 5 percent lower for the income standard and 10 percent lower for the income and region standard. This analysis uses the median as a more conservative benchmark, because the required cost reduction is lower.

11. See Brossard and Gacougnolle (2001) for a similar correction.

12. The mean primary repetition rate for the 121 developing countries reporting this statistic in the WDI is 9.3 percent, 43 developing countries have repetition rates greater than 10 percent and 17 have rates greater than 20 percent. This compares to an average of 3.5 percent for the 19 reporting high-income countries reporting the statistic, with only one observation greater than 10 percent. UNESCO (2003) provides the secondary repetition rate for 78 developing countries: the mean is 8.9 per cent; 27 countries have rates exceeding 10 percent and eight countries have rates exceeding 20 percent. This compares with a 6.0 percent mean for the 16 reporting high-income countries, and only one high-income country exceeding 10 percent.

13. See lines 6 and 7 in Table 4 in the Appendix for the formulas used to calculate needed enrollment under each absorption scenario.

**Table 6**: Unit Costs (in Constant 2002 U.S. Dollars) under Different Scenarios, by Region and Income Group, per Enrolled Student

| | SSA | SA | EA&P | ME&NA | LA&C | E&CA | Total per country | Total per student |
|---|---|---|---|---|---|---|---|---|
| **Present Unit Costs** | | | | | | | | |
| Low Income | $128 | $86 | $136 | $249 | $122 | $125 | $127 | $126 |
| Lower-Middle Income | 417 | 82 | 382 | 369 | 325 | 307 | 337 | 244 |
| Upper-Middle Income | 820 | — | 1417 | 2180 | 919 | 1157 | 1219 | 884 |
| Country mean | 199 | 85 | 307 | 927 | 544 | 505 | 412 | — |
| Mean cost per student | 257 | 117 | 168 | 571 | 577 | 462 | — | 296 |
| **Best Practice by Income Group** | | | | | | | | |
| Low Income | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| Lower-Middle Income | 290 | 290 | 290 | 290 | 290 | 290 | 290 | 290 |
| Upper-Middle Income | 877 | — | 877 | 877 | 877 | 877 | 877 | 877 |
| Country mean | 139 | 122 | 203 | 459 | 505 | 398 | 302 | — |
| Mean cost per student | 138 | 71 | 247 | 338 | 725 | 329 | — | 292 |
| **Best Practice by Region and Income Group** | | | | | | | | |
| Low Income | 75 | 67 | 23 | 249 | 222 | 93 | 76 | 64 |
| Lower-Middle Income | 637 | 82 | 139 | 384 | 312 | 219 | 299 | 221 |
| Upper-Middle Income | 785 | — | 1417 | 1555 | 877 | 902 | 1014 | 938 |
| Country mean | 171 | 69 | 145 | 741 | 527 | 384 | 336 | — |
| Mean cost per student | 231 | 67 | 132 | 492 | 734 | 300 | — | 268 |

Source: Author's calculations based on data from WDI and UNESCO-UIS.

Note: Best-practice country cost is the median unit cost by income group or region and income group for countries with net enrollment rates higher than predicted by regressions of region and income interactions.

Finally, I consider two alternative target dates—2015 and 2025—for achieving universal secondary schooling.

Table 6 presents mean unit costs both for countries and per student, by region and income group for all developing countries. Recall that countries with insufficient data are assigned the regional mean unit cost. Student-weighted costs, which indicate the mean per student cost, are quite similar across the three unit cost scenarios, at $296 using present unit costs, $292 using median cost for best-practice countries by income group, and $268 using median cost for best-practice countries by income group and region. The distribution of students, however, is different from the distribution of

**Table 7**: Additional Spending (in Constant 2002 U.S. Dollars) to Achieve Immediate 90 Percent Net Enrollment Rates at the Secondary Level under Alternative Cost and Absorption Assumptions

| | Present costs | | | Best practice by income group | | Best practice by region and income group | |
|---|---|---|---|---|---|---|---|
| | Population to be enrolled (1000s) | Cost per new enrollee | Total cost (millions) | Cost per new enrollee | Total cost (millions) | Cost per new enrollee | Total cost (millions) |
| **Absorption assumption 1: New spaces for all new enrollees, no change in repetition rates** | | | | | | | |
| SSA | 90,587 | $132 | $11,965 | $76 | $6,851 | $97 | $8,766 |
| SA | 88,222 | 116 | 10,270 | 68 | 5,958 | 67 | 5,923 |
| EA&P | 87,031 | 153 | 13,314 | 219 | 19,039 | 113 | 9,843 |
| ME&NA | 16,559 | 743 | 12,307 | 322 | 5,325 | 483 | 7,992 |
| LA&C | 22,589 | 472 | 10,671 | 564 | 12,737 | 578 | 13,049 |
| E&CA | 7,843 | 424 | 3,327 | 262 | 2,055 | 212 | 1,666 |
| Low income | 203,045 | 123 | 25,069 | 65 | 13,229 | 68 | 13,730 |
| Lower-middle income | 93,360 | 217 | 20,220 | 276 | 25,804 | 204 | 19,035 |
| Upper-middle income | 16,426 | 1,008 | 16,565 | 787 | 12,932 | 881 | 14,475 |
| **TOTALS** | **312,832** | **$198** | **$61,854** | **$166** | **$51,965** | **$151** | **$47,239** |
| **Absorption assumption 2: Reduction of repetition rate to 7% allows some existing capacity to be used for new enrollees** | | | | | | | |
| SSA | 67,492 | $119 | $8,016 | $69 | $4,669 | $81 | $5,475 |
| SA | 88,321 | 116 | 10,285 | 68 | 5,964 | 67 | 5,928 |
| EA&P | 68,977 | 154 | 10,554 | 233 | 16,078 | 117 | 8,066 |
| ME&NA | 11,659 | 688 | 7,792 | 325 | 3,789 | 490 | 5,708 |
| LA&C | 10,453 | 388 | 4,065 | 541 | 5,651 | 560 | 5,858 |
| E&CA | 7,311 | 384 | 2,988 | 259 | 1,891 | 205 | 1,499 |
| Low income | 176,775 | 123 | 21,746 | 66 | 11,693 | 68 | 11,937 |
| Lower-middle income | 70,825 | 202 | 14,295 | 290 | 20,552 | 193 | 13,691 |
| Upper-middle income | 6,613 | 1,158 | 7,660 | 877 | 5,797 | 1,044 | 6,906 |
| **TOTALS** | **254,213** | **$172** | **$43,700** | **$150** | **$38,042** | **$128** | **$32,534** |

Source: Author's calculations based on data from WDI and UNESCO-UIS.

Note: Totals reflect figures for all new students. The region and income panels are different decompositions of the same underlying totals.

out-of-school children, with the latter disproportionately in poorer countries. As a result, one could expect even lower costs for each new enrollee.

Table 7 shows the expense of increasing school spaces so as to achieve instantaneous universal secondary education according to each cost scenario and absorption assumption. Under present costs, and if repetition rates are unchanged and new spaces for unenrolled students (inflated by the repetition rate) need to be created, the per new enrollee cost is $198. Under present costs, but with a reduction in the repetition rate to 7 percent, the cost per new enrollee falls to $172, for total additional spending requirements of $62 billion and $44 billion, respectively. The lower per new enrollee unit costs calculated under the assumption of lower repetition rates points to the fact that the countries with larger discrepancies between the GER and the NER tend to be the lower-cost countries.

Under costs determined according to the median cost of the best-practice countries by income group, the per new enrollee cost falls to $166 and $150, yielding total new spending levels of $52 billion with no change in the repetition rate and $38 billion with a 7 percent repetition rate. Under costs ascribed from the median-cost best-practice countries by income group and region, the per new enrollee costs are lower still, at $151 and $128, with total new spending of $47 billion and $33 billion, depending on the repetition assumptions.

The best-practice spending totals include savings on currently enrolled students in countries where present costs exceed best-practice costs—the case for most countries. In some instances, these savings on current students exceed the spending needed to enroll new students. These countries are not included in the totals, as this would imply that their savings could be used to defray spending in other countries. For other countries, the best-practice costs exceed present costs.[14] These countries face increased costs for students already enrolled. The last row in each panel shows that the amount of spending directed to these students is a sizable share of the total needed to achieve universal secondary schooling.

Table 8 shows the cost requirements for gradually increasing the enrollment rate to universal access by 2015 or 2025, using present cost and best-practice cost by income and region, and reducing repetition rates to 7 percent over the full period. The calculations include additional costs (or cost savings) incurred for existing students under the best-practice scenario. They assume a 1.6 percent annual growth in enrollment rates, which is the median growth rate for all developing countries.[15] Thus, some of the cost savings over an extended time horizon result from expansion that could reasonably have been expected to occur anyway.[16] The predicted decline in the secondary

14. For best-practice countries with present costs below the median, I use their present costs as best-practice costs.

15. Enrollment rate growth is the average annual growth for countries reporting NERs in the 1998–2000 period. Where NERs were unavailable, GERs were used.

16. Most countries in the sample also can expect to see income growth in the next 15–25 years. I assume that this growth, at the current share of GDP spent on education, will finance the predicted growth in the NER and the expected increases in teacher salaries due

school age population between 2005 and 2011 also moderates costs. The estimates show that increasing school spaces to achieve universal secondary schooling by 2015 would cost $34 billion annually under present costs and repetition rates, and $28 billion annually under best-practice costs. With a gradual reduction in the repetition rate to 7 percent, the average annual costs under the present and best-practice cost structures are $32 and $27 billion, respectively. The difference between the estimate with no change in cost structure and repetition rates and the estimate with best-practice costs and 7 percent repetition is 21 percent.

Under a 25-year time frame, the average annual cost to expand educational systems to achieve universal enrollment is $28 billion, at present costs and repetition rates. Under best-practice costs and repetition rates, the cost falls to $22 billion, a 21 percent reduction. Over 25 years, but with universal enrollment achieved at 15 years, the same cost comparison is $45 billion and $25 billion, implying a possible 45 percent reduction in costs.

Although it is certain that reduced repetition will lower the cost of secondary school expansion considerably, the "best-practice" scenarios depend on the ability of countries to adopt lower-cost systems. The best-practice simulations and their implications for savings underscore the need for research on the cross-country variation in education costs. At this time, and particularly without an understanding of the mechanics of lower-cost systems, it would be imprudent to suggest that substantial cost reductions are possible. I therefore prefer the estimates based on present costs, which suggest annual costs between $24 billion and $45 billion over the next 25 years, depending on the extent of repetition reduction, and the speed with which universal enrollment occurs.

Table 9 puts these spending levels in perspective by comparing them to current spending, calculating them as a percent of GDP, and determining the finance gap after countries have committed at least the median GDP share to education (based on the GDP share of high-performing countries by income group). This minimum is set at 4.1 percent of GDP for low-income countries, and 5.0 percent for middle-income countries. Not surprisingly, Table 9 shows that achieving universal secondary education imposes a heavy burden on the poorest countries. Under the 25-year time horizon and with present cost structures, low-income countries would need to more than double their current spending on secondary education, at a cost of nearly 2 percent of GDP. If the low-income countries were to increase their spending to the best-practice share of GDP, the annual foreign aid requirement would be $10.5 billion.

Achieving universal secondary schooling in middle-income countries would impose a much smaller financial burden. Under a 15-year horizon and 7 percent repetition rates, lower-middle-income countries would have to

to rising standards of living. Typically, teacher salaries rise in absolute terms as national income rises, but decline as a share of per capita income. This suggests that simply maintaining the share of GDP in education will easily cover these costs. Estimates for more rapid expansion than would otherwise occur are thus in addition to the costs that a country will incur under expected rates of school expansion and income growth.

**Table 8**: Cost Projections for Reaching 90 Percent NER in 15 and 25 years (in Millions of Constant 2002 U.S. Dollars)

| | | Repetition rates unchanged | | | | Repetition 7% or less | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 15-year horizon | | 25-year horizon | | 15-year horizon | | 25-year horizon | |
| Year | Population 12-17 (1000s) | Present costs | Best practice costs | Present costs | Best practice costs | Present costs | Best practice costs | Present costs | Best practice costs |
| 2001 | 649,490 | $4141 | $10,747 | $2042 | $9590 | $3853 | $10,546 | $1784 | $9383 |
| 2002 | 649,700 | 8310 | 13,169 | 4098 | 10,795 | 7731 | 12,766 | 3580 | 10,388 |
| 2003 | 649,910 | 12,509 | 15,635 | 6169 | 12,016 | 11,635 | 15,029 | 5387 | 11,406 |
| 2004 | 650,120 | 16,735 | 18,131 | 8254 | 13,253 | 15,564 | 17,317 | 7204 | 12,436 |
| 2005 | 650,330 | 20,990 | 20,697 | 10,353 | 14,503 | 19,519 | 19,676 | 9032 | 13,477 |
| 2006 | 649,938 | 25,274 | 23,172 | 12,468 | 15,661 | 23,496 | 21,941 | 10,871 | 14,436 |
| 2007 | 649,545 | 29,587 | 25,657 | 14,596 | 16,817 | 27,498 | 24,216 | 12,720 | 15,396 |
| 2008 | 649,153 | 33,928 | 28,137 | 16,738 | 18,010 | 31,524 | 26,481 | 14,579 | 16,375 |
| 2009 | 648,760 | 38,297 | 30,678 | 18,895 | 19,203 | 35,573 | 28,786 | 16,447 | 17,357 |
| 2010 | 648,368 | 42,695 | 33,222 | 21,065 | 20,391 | 39,654 | 31,107 | 18,324 | 18,332 |
| 2011 | 649,591 | 47,241 | 35,991 | 23,298 | 21,745 | 43,859 | 33,641 | 20,244 | 19,453 |
| 2012 | 650,814 | 51,836 | 38,776 | 25,553 | 23,114 | 48,105 | 36,189 | 22,178 | 20,628 |
| 2013 | 652,038 | 56,479 | 41,580 | 27,828 | 24,492 | 52,391 | 38,745 | 24,125 | 21,759 |
| 2014 | 653,261 | 61,169 | 44,400 | 30,124 | 25,876 | 56,717 | 41,300 | 26,084 | 22,983 |
| 2015 | 654,484 | 65,906 | 47,238 | 32,442 | 27,267 | 61,082 | 43,861 | 28,055 | 24,101 |
| 2016 | 657,962 | 64,858 | 46,727 | 34,720 | 28,703 | 29,090 | 22,772 | 29,995 | 25,264 |
| 2017 | 661,441 | 63,879 | 46,259 | 37,010 | 30,165 | 28,228 | 22,478 | 31,941 | 26,471 |
| 2018 | 664,919 | 62,875 | 45,778 | 39,311 | 31,648 | 27,435 | 22,269 | 33,892 | 28,188 |
| 2019 | 668,398 | 61,851 | 45,265 | 41,624 | 33,139 | 26,629 | 22,062 | 35,848 | 29,314 |
| 2020 | 671,876 | 60,801 | 44,734 | 43,948 | 34,637 | 25,815 | 21,844 | 37,809 | 30,441 |
| 2021 | 675,140 | 59,641 | 44,147 | 46,197 | 36,101 | 25,022 | 21,628 | 39,699 | 31,535 |
| 2022 | 678,405 | 58,539 | 43,543 | 48,448 | 37,569 | 24,222 | 21,413 | 41,590 | 32,636 |
| 2023 | 681,669 | 57,425 | 42,927 | 50,701 | 39,040 | 23,667 | 21,193 | 43,479 | 33,733 |
| 2024 | 684,934 | 56,325 | 42,298 | 52,956 | 40,513 | 23,138 | 20,976 | 45,364 | 34,824 |
| 2025 | 688,198 | 55,212 | 41,655 | 55,212 | 41,990 | 22,592 | 20,753 | 47,246 | 35,915 |
| Cost per year over 25-year period | | 44,660 | 34,822 | 28,162 | 25,049 | 29,361 | 24,760 | 24,299 | 22,249 |
| Cost per year over 15-year period | | 34,340 | 28,482 | | | 31,880 | 26,773 | | |

Source: Author's calculations based on data from WDI and UNESCO-UIS.

Note: Best-practice costs are the median cost by income group and region for countries performing better than predicted in a regression model of enrollment rates on region and income interactions.

**Table 9**: Indicators of Median Country Burden and External Aid Requirements for Achieving 90 Percent Net Enrollment Rates, Average Annual Spending over 25 Years (Spending in billions of constant 2002 U.S. dollars)

| | Repetition rates unchanged | | | | Repetition rates 7% or less | | | |
|---|---|---|---|---|---|---|---|---|
| | 15-year horizon | | 25-year horizon | | 15-year horizon | | 25-year horizon | |
| | Present costs | Best practice costs | Present costs | Best practice costs | Present costs | Best practice costs | Present costs | Best practice costs |
| **Low Income Countries** | | | | | | | | |
| Total present spending=$15.3 | | | | | | | | |
| Additional spending needed | $20.3 | $8.6 | $13.8 | $6.1 | $16.9 | $7.0 | $13.2 | $5.9 |
| As factor of present spending | 3.2 | 2.0 | 2.2 | 1.3 | 2.5 | 1.4 | 2.2 | 1.2 |
| As share of GDP | 2.8 | 1.2 | 2.0 | 0.6 | 2.1 | 0.8 | 1.9 | 0.6 |
| Foreign aid required after country spends best practice GDP | $16.9 | $6.7 | $11.1 | $4.7 | $13.6 | $5.1 | $10.5 | $4.5 |
| Country burden as factor of present spending after foreign aid paid | 0.20 | 0.08 | 0.19 | 0.03 | 0.16 | 0.06 | 0.14 | 0.02 |
| **Lower-Middle Income Countries** | | | | | | | | |
| Total present spending=$35.9 | | | | | | | | |
| Additional spending needed | $10.9 | $13.5 | $6.5 | $9.6 | $6.4 | $9.3 | $5.4 | $8.6 |
| As factor of present spending | 0.25 | 0.12 | 0.11 | 0.01 | 0.11 | 0.06 | 0.07 | 0 |
| As share of GDP | 0.3 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 |
| Foreign aid required after country spends best practice GDP | $5.3 | $5.8 | $3.3 | $4.1 | $2.9 | $3.5 | $2.7 | $3.5 |
| Country burden as factor of present spending after foreign aid paid | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **Upper-Middle Income Countries** | | | | | | | | |
| Total present spending=$41.8 | | | | | | | | |
| Additional spending needed | $13.4 | $12.7 | $7.9 | $9.3 | $6.0 | $8.5 | $5.7 | $7.8 |
| As factor of present spending | 0.05 | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| As share of GDP | 0.07 | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Foreign aid required after country spends best practice GDP | $8.9 | $7.7 | $4.6 | $4.6 | $3.4 | $4.4 | $3.8 | $4.2 |
| Country burden as factor of present spending after foreign aid paid | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **All Countries** | | | | | | | | |
| Total present spending=$93.0 | | | | | | | | |
| Additional spending needed | $44.7 | $34.8 | $28.2 | $25.0 | $29.4 | $24.8 | $24.3 | $22.2 |
| Foreign aid required after country spends best practice GDP | $31.1 | $20.2 | $19.0 | $13.4 | $19.9 | $13.0 | $17.0 | $12.2 |

Source: Author's calculations based on data from WDI and UNESCO-UIS.

increase spending by 7 percent over current spending on secondary education; the increase for upper-middle-income countries would be less than 1 percent. If countries are required to commit a minimum percent of GDP, the estimates suggest external funding requirements of $6.3 billion.

If low-income countries adopt the 25-year horizon and middle-income countries adopt the 15-year horizon, the combined external requirement is $16.8 billion annually. This amount is more than 25 percent of the $65 billion provided by official development assistance in 2002, and is about equal to the aid ear-marked for projects that address the UN's Millennium Development Goals, which include eradicating extreme poverty and hunger, achieving universal primary education, and improving health (UN Millennium Project, 2005). Thus, relative to the current level of external aid, $16.8 billion is a large sum.

## ACHIEVING UNIVERSAL SECONDARY EDUCATION

The foregoing discussion suggests that, depending on time horizon, cost structure, and repetition rates, the annual financial burden of providing enough school spaces to achieve universal secondary schooling in developing countries will fall between $22 billion and $45 billion annually. The above calculations reveal a seemingly rich potential in the workings of low-cost, high-performing education systems and in the significant savings that countries can reap if they are able to reduce repetition rates. Both of these tasks would require comprehensive case studies of how some countries produce exemplary outcomes at exceedingly modest costs.

Under present costs and repetition rates, the financial requirements of achieving universal secondary education are particularly onerous for low-income countries. Yet, if countries were to increase the share of their GDP committed to education to the median share adopted by high-performing countries, external finance requirements would fall by about 30 percent under most cost and repetition scenarios. Clearly, some combination of cost reform, repetition rate reduction, and increased national commitment would go a long way in making universal secondary schooling a reality.

# Appendix

**Table 1:** Study Population Countries by Region, Income Classification, and Population 12–17 Years of Age

| | Income group | Population 12–17 Years of Age (1000s) |
|---|---|---|
| ***Sub-Saharan Africa*** | | |
| Angola | Low | 1,703 |
| Benin | Low | 939 |
| Botswana | Upper-middle | 257 |
| Burkina Faso | Low | 1,757 |
| Burundi | Low | 1,007 |
| Cameroon | Low | 2,170 |
| Cape Verde | Lower-middle | 69 |
| Central African Republic | Low | 512 |
| Chad | Low | 1,074 |
| Comoros | Low | 105 |
| Congo, Rep. | Low | 482 |
| Cote d'Ivoire | Low | 2,427 |
| Democratic Rep. of the Congo | Low | 6,975 |
| Equatorial Guinea | Low | 60 |
| Eritrea | Low | 533 |
| Ethiopia | Low | 9,171 |
| Gabon | Upper-middle | 175 |
| Gambia | Low | 171 |
| Ghana | Low | 2,899 |
| Guinea | Low | 1,128 |
| Guinea-Bissau | Low | 183 |
| Kenya | Low | 4,969 |
| Lesotho | Low | 283 |
| Liberia | Low | 425 |
| Madagascar | Low | 2,165 |
| Malawi | Low | 1,491 |
| Mali | Low | 1,760 |
| Mauritania | Low | 355 |
| Mauritius | Upper-middle | 117 |
| Mozambique | Low | 2,474 |
| Namibia | Lower-middle | 251 |
| Niger | Low | 1,515 |
| Nigeria | Low | 16,379 |
| Rwanda | Low | 1,134 |
| Sao Tome and Principe | Low | 23 |
| Senegal | Low | 1,367 |
| Sierra Leone | Low | 590 |
| Somalia | Low | 1,224 |
| South Africa | Lower-middle | 5,860 |
| Sudan | Low | 4,164 |
| Swaziland | Lower-middle | 161 |
| Togo | Low | 643 |
| Uganda | Low | 3,400 |
| United Republic of Tanzania | Low | 5,147 |
| Zambia | Low | 1,505 |
| Zimbabwe | Low | 2,026 |

**Table 1:** Study Population Countries by Region, Income Classification, and Population 12–17 Years of Age, continued

| | Income group | Population 12–17 Years of Age (1000s) |
|---|---|---|
| ***South Asia*** | | |
| Afghanistan | Low | 2,902 |
| Bangladesh | Low | 19,019 |
| Bhutan | Low | 295 |
| India | Low | 127,056 |
| Maldives | Lower-middle | 44 |
| Nepal | Low | 3,176 |
| Pakistan | Low | 19,830 |
| Sri Lanka | Lower-middle | 2,134 |
| ***East Asia & Pacific*** | | |
| Cambodia | Low | 2,196 |
| China | Lower-middle | 132,931 |
| Dem. People's Rep. of Korea | Low | 2,228 |
| Fiji | Lower-middle | 104 |
| Indonesia | Low | 26,201 |
| Lao PDR | Low | 739 |
| Malaysia | Upper-middle | 2,725 |
| Micronesia, Fed. Sts. | Lower-middle | 16 |
| Mongolia | Low | 367 |
| Myanmar | Low | 5,884 |
| Papua New Guinea | Low | 700 |
| Philippines | Lower-middle | 10,267 |
| Samoa | Lower-middle | 25 |
| Solomon Islands | Low | 62 |
| Thailand | Lower-middle | 6,738 |
| Timor-Leste | Low | 130 |
| Tonga | Lower-middle | 14 |
| Vanuatu | Lower-middle | 29 |
| Viet Nam | Low | 10,534 |
| ***Middle East & North Africa*** | | |
| Algeria | Lower-middle | 4,370 |
| Djibouti | Lower-middle | 89 |
| Egypt | Lower-middle | 9,630 |
| Iran, Islamic Rep. | Lower-middle | 11,046 |
| Iraq | Lower-middle | 3,292 |
| Jordan | Lower-middle | 690 |
| Lebanon | Upper-middle | 427 |
| Libyan Arab Jamahiriya | Upper-middle | 804 |
| Malta | Upper-middle | 34 |
| Morocco | Lower-middle | 3,930 |
| Oman | Upper-middle | 333 |
| Palestinian Autonomous Territories | Lower-middle | 443 |
| Saudi Arabia | Upper-middle | 2,788 |
| Syrian Arab Republic | Lower-middle | 2,631 |
| Tunisia | Lower-middle | 1,269 |
| Yemen | Low | 2,697 |

**Table 1:** Study Population Countries by Region, Income Classification, and Population 12–17 Years of Age, continued

| | Income group | Population 12–17 Years of Age (1000s) |
|---|---|---|
| ***Latin America & Caribbean*** | | |
| Argentina | Upper-middle | 3,965 |
| Barbados | Upper-middle | 25 |
| Belize | Lower-middle | 34 |
| Bolivia | Lower-middle | 1,096 |
| Brazil | Upper-middle | 21,329 |
| Chile | Upper-middle | 1,628 |
| Colombia | Lower-middle | 5,055 |
| Costa Rica | Upper-middle | 502 |
| Cuba | Lower-middle | 989 |
| Dominican Republic | Lower-middle | 1,117 |
| Ecuador | Lower-middle | 1,623 |
| El Salvador | Lower-middle | 787 |
| Guatemala | Lower-middle | 1,657 |
| Guyana | Lower-middle | 94 |
| Haiti | Low | 1,275 |
| Honduras | Lower-middle | 919 |
| Jamaica | Lower-middle | 328 |
| Mexico | Upper-middle | 12,732 |
| Nicaragua | Low | 741 |
| Panama | Upper-middle | 349 |
| Paraguay | Lower-middle | 766 |
| Peru | Lower-middle | 3,288 |
| St. Lucia | Upper-middle | 19 |
| St. Vincent and the Grenadines | Lower-middle | 17 |
| Suriname | Lower-middle | 59 |
| Trinidad and Tobago | Upper-middle | 169 |
| Uruguay | Upper-middle | 310 |
| Venezuela | Upper-middle | 3,099 |

**Table 1:** Study Population Countries by Region, Income Classification, and Population 12–17 Years of Age, continued

| | Income group | Population 12–17 Years of Age (1000s) |
|---|---|---|
| ***Europe & Central Asia*** | | |
| Albania | Lower-middle | 354 |
| Armenia | Low | 382 |
| Azerbaijan | Low | 1,052 |
| Belarus | Lower-middle | 1,020 |
| Bosnia and Herzegovina | Lower-middle | 380 |
| Bulgaria | Lower-middle | 649 |
| Croatia | Upper-middle | 349 |
| Czech Republic | Upper-middle | 791 |
| Estonia | Upper-middle | 131 |
| Georgia | Low | 514 |
| Hungary | Upper-middle | 738 |
| Kazakhstan | Lower-middle | 1,934 |
| Kyrgyzstan | Low | 665 |
| Latvia | Upper-middle | 224 |
| Lithuania | Upper-middle | 332 |
| Poland | Upper-middle | 3,823 |
| Republic of Moldova | Low | 497 |
| Romania | Lower-middle | 2,056 |
| Russian Federation | Lower-middle | 14,623 |
| Serbia and Montenegro | Lower-middle | 964 |
| Slovak Republic | Upper-middle | 512 |
| Tajikistan | Low | 909 |
| Former Yugoslav Rep. of Macedonia | Lower-middle | 197 |
| Turkey | Lower-middle | 8,566 |
| Turkmenistan | Lower-middle | 647 |
| Ukraine | Low | 4,591 |
| Uzbekistan | Low | 3,562 |

Income group designated by the following ranges of per capita gross national income calculated using the World Bank Atlas method:

$735 or less—Low income
$736–$2935—Lower-middle-income
$2936–$9075—Upper-middle-income

Source: World Bank 2003 list of developing countries and UNESCO (for population figures).

**Table 2:** Study Population Countries included in TIMSS

| | Income group | Region |
|---|---|---|
| Bulgaria | Lower-middle | E&CA |
| Czech Republic | Upper-middle | E&CA |
| Hungary | Upper-middle | E&CA |
| Indonesia | Low | EA&P |
| Iran, Islamic Rep. | Lower-middle | ME&NA |
| Jordan | Lower-middle | ME&NA |
| Latvia | Upper-middle | E&CA |
| Lithuania | Upper-middle | E&CA |
| Malaysia | Upper-middle | EA&P |
| Morocco | Lower-middle | ME&NA |
| Philippines | Lower-middle | EA&P |
| Republic of Moldova | Low | E&CA |
| Romania | Lower-middle | E&CA |
| Russian Federation | Lower-middle | E&CA |
| Slovak Republic | Upper-middle | E&CA |
| South Africa | Lower-middle | SSA |
| Thailand | Lower-middle | EA&P |
| Former Yugoslav Rep. of Macedonia | Lower-middle | E&CA |
| Tunisia | Lower-middle | ME&NA |
| Turkey | Lower-middle | E&CA |

Source: 1999 TIMSS and World Bank 2003 list of developing countries.

**Table 3:** Best Practice Countries by Performance Criteria

| | Net Enrollment Rate | | TIMSS |
|---|---|---|---|
| | High relative to income | High relative to income & region | High relative to income[1] |
| ***Sub-Saharan Africa*** | | | |
| Botswana | X | X | |
| Eritrea | | X | |
| Gambia | | X | |
| Ghana | | X | |
| Liberia | | X | |
| Malawi | | X | |
| Mauritius | X | X | |
| Namibia | | X | |
| Sierra Leone | | X | |
| South Africa | | X | 0 |
| Swaziland | | X | |
| Zimbabwe | | X | |
| ***South Asia*** | | | |
| None | | | |
| ***East Asia & Pacific*** | | | |
| Indonesia | | | X |
| Malaysia | X | X | 0 |
| Mongolia | X | X | |
| Philippines | X | X | 0 |
| Samoa | X | X | |
| Tonga | X | X | |
| Viet Nam | X | X | |
| ***Middle East & North Africa*** | | | |
| Algeria | X | X | |
| Egypt | X | X | |
| Jordan | X | X | 0 |
| Lebanon | X | X | |
| Malta | X | X | |
| Tunisia | X | X | 0 |
| ***Latin America & Caribbean*** | | | |
| Argentina | X | X | |
| Barbados | X | X | |
| Belize | X | X | |
| Bolivia | X | X | |
| Brazil | X | X | |

**Table 3:** Best Practice Countries by Performance Criteria, continued

| | Net Enrollment Rate | | TIMSS |
|---|---|---|---|
| | High relative to income | High relative to income & region | High relative to income[1] |
| Chile | X | X | |
| Colombia | | X | |
| Jamaica | X | X | |
| Nicaragua | | X | |
| Panama | X | X | |
| Peru | X | X | |
| St. Lucia | X | X | |
| Trinidad and Tobago | X | X | |
| Uruguay | X | | |
| ***Europe & Central Asia*** | | | |
| Albania | X | | |
| Armenia | X | | |
| Azerbaijan | X | X | |
| Belarus | X | | |
| Bulgaria | X | X | X |
| Czech Republic | | | X |
| Estonia | X | | |
| Georgia | X | | |
| Hungary | X | X | X |
| Kazakhstan | X | X | |
| Latvia | X | | X |
| Lithuania | X | X | X |
| Poland | X | X | |
| Republic of Moldova | X | | X |
| Romania | X | X | X |
| Russian Federation | | | X |
| Slovak Republic | X | | X |
| Tajikistan | X | X | |
| The Former Yugoslav Rep. of Macedonia | X | | 0 |
| ***Total number of high performing countries*** | 43 | 45 | 10 |

[1] A zero shows that the country has a TIMSS score, but is not a best-practice country.

Source: Author's calculations based on data from WDI and TIMSS.

**Table 4:** Derivation of Spending Calculations

| |
|---|
| **Unit Costs** |
| 1. Total Education Expenditure = [Share of GDP in Education Spending (current and capital)] X [2000 Country GDP in constant 2002 US dollars] |
| 2. Spending on Secondary Education= [1] X [Share of Total Education Expenditure at Secondary level] |
| 3. Students = GER X [Population 12–17 years of age] |
| 4. Present Unit Cost = [2] / [3] |
| 5. "Best Practice" Unit Cost = Median cost among countries with better outcomes |
| **Absorption Scenarios** |
| 6. Number of Children Who Need to Enroll to Achieve 90%, at Current Repetition = [0.9 – NER] X [Population 12–17 years of age] X GER/NER |
| 7. Number of Children Who Need to Enroll to Achieve 90%, at 7% Repetition = [0.9 – GER(1-.07)] X [Population 12–17 years of age] X 1.07* |
| **Spending Needed to Achieve Universal Secondary Enrollment** |
| 8. Present Unit Costs, No Change in Repetition = [4] X [6] |
| 9. Present Unit Costs, Repetition Capped at 7%= [4] X [7] |
| 10. Best Practice Unit Costs, No Change in Repetition = [5] X [6] |
| 11. Best Practice Unit Costs, Repetition Capped at 7% = [5] X [7] |

*This calculation assumes that places can be converted from over-age to appropriate-age students.

# References


Binder, Melissa, and Christopher Woodruff. 2002. "Inequality and Intergenerational Mobility in Schooling: The Case of Mexico." *Economic Development and Cultural Change* 50 (2): 249–67.

Bloom, David. 2006. *Measuring Global Educational Progress.* Cambridge, MA: American Academy of Arts and Sciences.

Brossard, Mathieu, and Luc-Charles Gacougnolle. 2001. "Financing Primary Education for All: Yesterday, Today and Tomorrow." Paris: UNESCO.

Bruns, Barbara, Alain Mingat, and Ramahatra Rakotomalala. 2003. *Achieving Universal Primary Education by 2015: A Chance for Every Child*. Washington, DC: The World Bank.

Colclough, Christopher, with Keith Lewin. 1993. *Educating All the Children: Strategies for Primary Schooling in the South.* Oxford: Clarendon Press.

Delamonica, Enrique, Santosh Mehrotra, and Jan Vandemoortele. 2001. "Is EFA Affordable? Estimating the Global Minimum Cost of 'Education for All.'" Innocenti Working Paper No. 87. Florence: UNICEF Innocenti Research Center.

Devarajan, Shantayanan, Margaret J. Miller, and Eric V. Swanson. 2002. "Goals for Development: History, Prospects and Costs." World Bank Working Paper. Washington, DC: The World Bank.

Hannum, Emily, and Claudia Buchmann. 2003. *The Consequences of Global Educational Expansion: Social Science Perspectives*. Cambridge, MA: American Academy of Arts and Sciences.

Inter-American Development Bank (IDB). 1998. *Facing Up to Inequality in Latin America: Economic and Social Progress in Latin America, 1998–1999 Report.* Washington, DC: Inter-American Development Bank.

Jimenez, Emmanuel. 1986. "The Structure of Educational Costs: Multiproduct Cost Functions for Primary and Secondary Schools in Latin America." *Economics of Education Review* 5 (1): 25–39.

Lewin, Keith, and Francoise Caillods. 2001. *Financing Secondary Education in Developing Countries: Strategies for Sustainable Growth*. Paris: UNESCO.

Organization of Economic Co-operation and Development (OECD) and UNESCO Institute of Statistics (UNESCO-UIS). 2003. *Financing Education —Investments and Returns: Analysis of the World Education Indicators, 2002 Edition*. Paris: UNESCO-UIS/OECD.

Psacharopoulos, George. 1994. "Returns to Investment in Education: A Global Update." *World Development* 22 (9): 1325–43.

Tsang, Mun. 1994. "Costs of Education In China: Issues Of Resource Mobilization, Equality, Equity And Efficiency." *Education Economics* 2 (3): 287–312.

UNESCO Institute for Statistics. 2003. *Global Education Digest 2003: Comparing Education Statistics Across the World.* Montreal: UNESCO Institute for Statistics.

UN Millennium Project. 2005. "Resources Required to Finance the Millennium Development Goals." In *Investing in Development: A Practical Plan to Achieve the Millennium Development Goals*. New York: United Nations Development Programme.

Verry, D.W. 1986. "Educational Cost Functions." Pp. 400–409 in *Economics of Education: Research and Studies*, ed. George Psacharopoulos. Oxford: Pergamon Press.

# Contributors

**Melissa Binder** is an associate professor in the Department of Economics at the University of New Mexico, where she teaches courses on labor economics and Latin American development. Much of her research concerns education decisions in the United States and Mexico. She has also written on the relationship between education and the motherhood wage gap in the United States.

**Paul Glewwe** is an associate professor in the Department of Applied Economics at the University of Minnesota, where he teaches courses on econometrics, the microeconomics of economic development, and demand theory. His research focuses almost exclusively on developing countries, and includes the following topics: education, child health, inequality and poverty, and the design of household surveys. Previously he was a senior economist in the Development Research Group at the World Bank. He has worked in and conducted research on many countries in Africa, Asia, Latin America, and the Middle East.

**Meng Zhao** is a Ph.D. student in the Department of Applied Economics at the University of Minnesota. Her research focuses on development economics with special interest in education, health, and agriculture in China. She has also worked as a consultant for the World Bank, analyzing longitudinal survey data collected in rural China and cross-country data on education in Africa.

## The Project on Universal Basic and Secondary Education

Directed by Joel E. Cohen (Rockefeller and Columbia Universities) and David E. Bloom (Harvard University), the Academy's project on Universal Basic and Secondary Education (UBASE) is sponsoring a series of multidisciplinary studies of the rationale, means, and consequences of providing an education of high quality to all children in the world. Working groups are investigating a number of topics including: basic facts and data on educational expansion, history of educational development, consequences of attaining universal education, means of educational expansion, goals and assessment of universal education, politics and obstacles to educational reform, costs of universal education, and health and education. The UBASE project is supported by grants from the William and Flora Hewlett Foundation, John Reed, the Golden Family Foundation, Paul Zuckerman, an anonymous donor, and the American Academy of Arts and Sciences.

## Advisory Committee



For more information, please contact:
Project on Universal Basic and Secondary Education
American Academy of Arts and Sciences
136 Irving Street, Cambridge, MA 02138
Phone: 617-576-5024
email: ubase@amacad.org
http://www.amacad.org/projects/ubase.aspx

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