Measuring Global Educational Progress

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ISBN: 0-87724-057-4

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Preface

Education is one of the largest and most important investments made by governments and people. Understanding whether this investment leads to the desired ends is crucial to effective government policy and private decision-making. What is known, statistically, about the current state of education across the world? What are the sources and quality of basic statistical data? Most efforts to collect data focus on the inputs into education, the investments of money and time in the education system. These data shed light on differences between countries and regions, but are incomplete. Information on other aspects of education—e.g., on what is taught and how, on what is learned, and on the long-term consequences of investments in education—are even scarcer. Governments need more, and more reliable, information upon which to base their decisions about education.

Some overarching facts and trends are clear. Worldwide, approximately 97 million children of primary school age and 226 million of secondary school age are not enrolled in school. At current rates of educational progress and demographic change, the corresponding figures in 2015 are projected to be similar (with an increase in the number of primary-aged children not enrolled and a decrease for secondary-aged children).

Developed countries have now achieved very high levels of access to primary and secondary education. Educational attainment and completion rates in these countries are also high. Some developing regions, in particular East Asia and Latin America and the Caribbean, likewise have very high enrollment ratios, but only in primary education. Attainment and completion rates still demand improvement. On nearly all measures, South Asia and Sub-Saharan Africa lag far behind. Gender differences in favor of boys are common in most developing regions, though not in Latin America and the Caribbean or in Eastern Europe and Central Asia. Gender differences are particularly pronounced in some Sub-Saharan African countries.

Although measures of the quality of education are inadequate, the data we have indicate that the gap in education quality between rich and poor countries is large and shows no signs of narrowing. Based on extrapolations from the small body of country test-score data, an estimated 75–95 percent of the world's children live in countries where education quality falls short of the average among OECD countries.

The dearth of data on education quality, in conjunction with limited data on education outputs, makes it difficult to reach definitive conclusions about the effectiveness of educational practices. Worse still, the validity of some of the most prominent schooling attainment data must be questioned, in light of serious internal inconsistencies revealed in the analyses below. Available cross-country data do not always appear to be consistent across the leading country-level data sets or with country-specific population data.

Evidence-based policymaking holds great promise, but that promise can only be realized when relevant and accurate data are available. Greater and better-coordinated efforts by international organizations could overcome years of insufficient funding and conflicting priorities for data collection, thus improving the quantity and quality of education data. This improvement has begun (particularly through the efforts of the UNESCO Institute for Statistics). Because such efforts may be politically delicate for some governments, close coordination and tactful diplomacy with countries that supply data, as well as with end users, will be important.

An earlier version of this paper was reviewed and discussed by experts at a daylong workshop held at the American Academy in Cambridge, Massachusetts on March 10, 2004. We thank the following participants for their comments: Leslie Berlowitz (American Academy), Henry Braun (Educational Testing Service), Barbara Bruns (World Bank), Michael Clemens (Center for Global Development), Tamara C. Fox (William and Flora Hewlett Foundation), Emily Hannum (University of Pennsylvania), Edilberto Loaiza (UNICEF), Albert Motivans (UNESCO), Jeffrey Puryear (Inter-American Dialogue), Laura Salganik (American Institutes for Research), Joel Sherman (American Institutes for Research), and Annababette Wils (Academy for Educational Development). Denise Lievesley was an important advisor on the paper from its inception. Joel E. Cohen, Tamara Fox, Martin Malin and six anonymous reviewers provided written comments. Kate Bendall, Diana Bowser, Anna Cederberg, Victoria Collis, Jane Frewer, Darren Morris, Nina Ni, Edward Reed, Larry Rosenberg, David Steven, and Meghan Tieu provided considerable assistance in the preparation of this paper. A special thanks is due to Helen Curry at the American Academy, whose intellectual contributions, project coordination, and copy-editing 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:

- 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;
- the costs of achieving universal education at the primary and secondary levels;
- health and education; and
- the 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 perspectives, 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 listed at the back of this volume.

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

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Measuring Global Educational Progress

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The 1990 World Conference on Education for All at Jomtien pledged to achieve universal primary education by 2000. By the turn of the century, progress toward this goal in low- and middle-income regions ranged from a 97 percent primary education completion rate in East Asia/Pacific to 51 percent in Sub-Saharan Africa—the latter an increase of just 1 percentage point over 1990 levels (World Bank, 2003). The second Millennium Development Goal (MDG), on universal primary education, extended the deadline to 2015, and official estimates state that up to 32 developing countries may realize the target by this date, in addition to the 37 that have already done so (World Bank, 2003).[1]

Although there has been some progress at the primary level, secondary education has historically received relatively little international funding or attention. For example, between 1965 and 1995 the Inter-American Development Bank (IDB) lent over a billion dollars for the development of primary schooling, but made no investment at the secondary level (Bloom, 2004). However, as the international labor market increasingly demands more sophisticated skills than primary schooling provides, there is growing recognition that secondary education is a vital stimulus for development.[2] Further, as more children complete primary schooling, demand for secondary education naturally increases among students and their parents. As a result, an exclusive concentration on primary education is neither desirable nor feasible.

Equal attention must be directed toward the quality of education offered. In theory at least, all parties—parents, students, employers, taxpayers—have a greater interest in whether a student has been effectively educated than in the time a student has spent in the schooling system. At present, three of the four indicators selected to monitor progress toward the second MDG—net enroll-

1. *Towards Universal Primary Education* (UN Millennium Project, 2005) is a very useful new study that focuses on the measures needed to reach two of the Millennium Development Goals—those on universal primary education and gender equality in education.

2. "It is now generally recognized that, for economic growth to take place, a high proportion of the population has to have received secondary education" (Delors, 1996).

ment, attainment of fifth grade schooling, and completion of primary schooling—focus entirely on the quantity of education available. Although the fourth, the literacy rate for 15 to 24 year olds, is an important indicator of the quality of education, data in this area are notoriously inconsistent (Puryear, 1995).

This paper surveys and assesses the basic data available to inform any effort to achieve universal education. The paper analyzes and reviews the nature and quality of information available to measure and assess primary and secondary education, focusing on the information needed to help achieve a quality universal education for all children through these educational levels.

The paper also provides an overview of selected, currently available indicators. It focuses on three categories: enrollment, quality, and educational attainment. Without enrollment, there is no formal education to speak of. Quality is necessary, because without it schooling is an empty shell. And completion is essential, as succeeding in today's world requires ever-higher levels of knowledge and training. The section presents descriptive analyses of a selection of existing cross-country datasets and identifies the major trends and patterns that relate to the achievement of universal basic and secondary education (UBASE). The section also explores the covariates and determinants of educational development, gender differences and the pace at which they are changing, and projections for a number of educational indicators.[3]

The final section summarizes the paper and explores policy implications—with respect both to the future of the global system of educational data collection and the achievement of UBASE.

3. This essay is restricted to the indicators that most directly facilitate assessment of the state of primary and secondary education. There are other indicators that are important (such as financing of education and the political environment in which decisions are made), but which receive little or no attention. The issue of finance, in particular, is beyond the scope of this paper. A serious treatment of educational finance would have to first ensure data comparability. Among the issues to be resolved (with difficulty, given the current state of the data) are: the use of local versus internationally comparable currencies, real versus nominal figures, and current expenditures versus capital expenditures versus total expenditures.

Education Data: What are Available, What are Needed

> *"The world has only limited information with which to monitor and evaluate one of its major investments."*
> —Puryear, 1995

Public investment in education typically accounts for 10 to 25 percent of a country's public spending. In some countries, the education ministry is the largest employer. Despite the magnitude of this investment, astonishingly little can be confidently asserted about education systems. Examining the nature and quality of existing data on education, tracing the evolution of educational indicators, and asking questions about how data can be developed are important foundations for the realization of universal basic and secondary education. Robust measurement systems are vital to effective goal setting. This issue is particularly pressing for policymakers and researchers concerned with education quality.

As this study shows, educational statistics are underdeveloped. Little investment has been made in this area, in comparison to the vast amount of money spent on educational provision. The availability and quality of data on basic indicators of progress (e.g., enrollment, completion of schooling) are far from ideal. Equity indicators are particularly lacking; although there are considerable data on gender differences in education, there are little systematic data on urban/rural disparities, and little on racial and ethnic divides. In this, there is a marked contrast between education and other areas of social policy. Economic and demographic indicators, for example, are relatively robust in comparison to their educational counterparts.

Within countries, the collection and aggregation of many quantitative educational statistics, including enrollment, are open to misinterpretation and corruption. Differences of application are common from country to country, as are missing data. Meanwhile, it is unclear whether currently available information meets the needs of all involved groups. Parents and students, with strong personal interests in schooling, are as vital to educational decision making as governments and transnational organizations but may lack adequate information on which to base their choices. The same types of information that are used for cross-national comparisons, if replicated within a country to compare sub-national regions, would be useful to parents and students. This data would shed light on the ability of a country's education system to educate students of different backgrounds and from different regions.

This section investigates the basic facts about education around the world, and the nature, temporal and geographic scope, quality, comparability, and accuracy of existing data that underpin this information. It opens with a discussion of the type of indicators that *could* be collected about education given plentiful resources and capacity, and develops a conceptual framework that splits available data into input, process, output, and outcome measures. This framework is used to provide a critical analysis of the quality of existing measures. A large number of deficits are identified, and the section concludes by asking what difference these deficits make in progress toward universal basic and secondary education. Would better information improve the quantity and quality of education? If so, what changes in the creation and use of educational data would generate this improvement?

WHAT COULD BE COLLECTED?

> *"Achieving [the UN Millennium Development Goal for education] will require a level of international resources and commitment not yet seen; it will also require better tools for monitoring educational progress."*
> —Lloyd and Hewett, 2003

Measures that assess progress in education can be divided into four basic types:[4]

Inputs, or measures of investments in the educational system, such as money and time (of students or teachers);

Processes, or measures of the functioning fabric of the system, such as qualifications of teachers, or lesson quality;

Outputs, or measures of direct results of the education process, such as literacy and numeracy levels, or specific competencies gained; and

Outcomes, or measures of long-term effects or consequences of the education process, such as the rate of return on schooling, or the effects of education on innovation or governance.

Most of the education indicators that are available for a comparative international assessment of education are input measures. Among these are enrollment data from UNESCO and attainment and completion data from Barro-Lee (2000) and Cohen-Soto (2001).[5]

Process measures, which show how countries use their inputs, are scarce and in some instances—think of the educational content and pedagogical style of a history, math, science, or literature curriculum—difficult to quan-

4. Some measures span more than one category. In particular, the distinction between inputs and processes is not always clear-cut. In addition, some measures, such as attainment and completion rates, can be considered either inputs or outputs. These rates are inputs in the sense that they are closely related to duration of schooling and reflect the amount of time that students spend in school. They can also measure output, as they reflect the accomplishments of an education system in passing students through a prescribed set of educational steps (sometimes measured, validated steps). In this paper, the Bruns et al. 2003 data on completion rates, which appear to be output measures, are just a different way to assess inputs. They measure, over a long period of time, a country's efforts to expose its students to a given level of education.

5. Average years of schooling are also reported, but this measure is not used in this paper.

tify. Information on the types of schools in an educational system should be more tractable, but cross-country cultural and economic differences bedevil analysis. Understanding differences in accreditation would be useful, but for similar reasons has proven daunting.[6]

Outputs—particularly those that focus on the quality of what an education system produces—are measured, but data are somewhat unreliable and sparse. Literacy rates are available, but differing standards across countries make comparisons somewhat problematic. In recent years, more countries have begun to participate in standardized tests, but only a small fraction of these are developing countries. Outputs are attractive measures of an education system, but some of the most important outputs of schooling "[reside] in the mind, which is relatively resistant to direct observation and precise analysis" (Puryear, 1995). All the same, the more straightforward output measures (such as literacy rates and standardized test scores) are extremely important in assessing the quality of learning.

Finally, it is especially important to distinguish between outputs and outcomes. If a cadre of students is successfully educated to a given level, does this have the predicted impact on individuals, economies, and societies? Outcomes are the least straightforward class of indicators to obtain, as understanding the effect of the education system on health or government corruption, for example, requires extensive analysis, not just measurement.

Hence, the framework of this paper rests heavily on input measures, with considerable attention given to attainment and completion rates. This is unfortunate, because it is difficult to assess a system's overall operation when the best data do little to reflect the overall quality of a country's efforts.

Input Measures

Inputs are indicators of investment in the educational system. Combined with outcome and output measures, input measures allow high-level decisions to be made about investment in education. How much should be spent? On what should this money be spent, and by whom? What proportions of expenditure should be directed at different levels of education and at different priorities within each level?

A considerable proportion of primary and secondary education is purchased publicly by societies, under the assumption that education is a public good. However, some countries, such as South Korea, have expanded educational access through heavy reliance on private schools, and every country has some privately financed education. Private money is also used within public school systems, for transport, books, and other school equipment. In theory, it should be possible to provide figures for public and private expenditure per student at different levels of education, as well as aggregate figures at the national level. Accounts could be provided to show the proportion of invest-

6. I do not mean to imply that processes have not been studied extensively. Indeed, a considerable number of cross-country studies have taken place and been documented. Stigler and Hiebert (1999) review ideas from around the world, as do various articles in recent editions of *Comparative Education Review.*

ment directed toward administration, school infrastructure and supplies, staffing, and staff development.

As described below, data of this quality are available from very few countries and are not in a format that allows easy comparison between countries, although UNESCO's International Standard Classification of Education (ISCED) has taken steps to address this problem. Reliable data on even the most basic expenditures are often hard to come by. In Uganda, for example, Puryear (1995) reported that the Ministry of Finance believed the country had around 85,000 primary teachers, while the Ministry of Education estimated there were 140,000. These gaps in data make certain questions difficult to address, i.e., whether there is a straightforward relationship between the money spent on education and the outputs or outcomes achieved, or whether the proportion of public to private investment has any impact on results.[7]

Time is also an important input, particularly in developing countries, where the opportunity cost of time spent in school rather than as part of the labor force is often key in the decision to enroll a child in school or to continue education. This decision in turn may be influenced or overturned during the course of childhood by changed circumstances at the family, regional, or national level. Compulsory schooling limits the ability of students and their parents to choose whether to invest time in education or not; in either case, the cost remains real. Participation data are perhaps the most widely used education indicators; for example, they provide the measures of progress toward the second Millennium Development Goal.[8] Enrollment figures, however, can mask problems with attendance, and attendance indicators may conceal other issues, including grade repetition. In Uganda, enrollment was historically under-reported because parents paid schools per child enrolled, and a proportion of this income was payable from the school to the government. However, after schools became publicly funded on the basis of enrolled pupils, the incentive for schools to report higher numbers led to a leap in official enrollment levels (and perhaps in over-reporting).[9]

As with levels of funding, an increase in participation does not necessarily indicate an improvement in the quality of schooling. Indeed, at the community level, as opposed to the individual level, there may be a trade-off between

7. The difficulty of this particular question is illustrated by the contradictory results of available studies on the subject. Barro and Lee (2001), for example, find that more resources improve educational performance, as measured by international test scores, while Hanushek (1995) finds no strong relationship with spending, and Woessman (2000) maintains that, if anything, higher spending corresponds to poorer student performance.

8. Data on participation are discussed extensively in this paper. More precise definitions of the various measures appear at the appropriate points in this discussion, but, briefly, "enrollment" means that a child has been registered for school, "attainment" refers to a child's attendance at a particular level for at least some time, and "completion" refers to a child's having finished a particular level of education.

9. The strength of the incentive to distort enrollment rates very likely affects the amount of distortion. It would be interesting, in this and similar cases, to investigate whether there is any feasible and credible means to impute more accurate data by taking such incentives into account.

educational quantity and quality, because an increase in the number of students in the system may mean that teachers, classrooms, and other elements vital to a quality education are spread more thinly. Accurate data in this area could be used to determine the extent of such trade-offs and to compare the effectiveness of various educational systems in managing expansion.

Process Measures

Process measures have a quite different purpose from input measures. They are intended to provide the detailed information needed for effective management of the education system and should be useful for managers at all levels—from teachers with managerial responsibilities, to education ministers, and, given education's great importance, to heads of state. Schools are complex organizations surrounded by sizeable bureaucracies. Management of a school is a far from trivial undertaking, and many developed countries are facing new challenges in managing schools and school systems (OECD, 2001; OECD, 2004). Process data provide governments with the information they need as they develop policy to improve educational systems and recommend teaching methodologies. These data enable educational authorities to assess the performance of institutions and to set investment priorities. Finally, within schools, they enable head teachers to make decisions about issues such as staff performance. Measures of management practices, and of process measures more broadly, are predictably less established in developing countries with, in the worst case, countries suffering from near-total breakdown of management feedback systems.

The relationship between process and output measures is not necessarily straightforward. Woessman (2000), for example, suggests that smaller class sizes actually correspond to lower student performance. Similarly, Nabeshima (2003), in a study of schools in East Asia, finds that teachers' qualifications play a significant role in students' achievement in science but a much smaller role in math, and that the effects of class size are ambiguous.[10] Nabeshima also finds teacher autonomy to be of uncertain value. Whether or not these counterintuitive and rather controversial findings are justified, they should make us wary of assuming that a particular educational action will lead to the expected consequences for an individual or a society.

Output Measures

Output data measure what the educational process is producing, and, when combined with input data on time, money, and participation, are key to understanding the value of a country's education system. Output data measure the immediate quality and quantity of learning purchased publicly or privately.

Output measures could include any gauge of educational achievement, including literacy, numeracy, competencies of any type, and examination results. In theory, these are hard and relatively tangible indicators. Examination systems, for example, provide benchmark outputs for one level of edu-

10. This study, however, did not include very large classes such as those seen in Africa—the effect of class size may be more significant in this context.

cation and thus implicitly indicate the minimal level of accomplishment that can be expected of students entering the next level. They offer students, parents, and employers a simple measure of educational achievement, and allow comparisons across and between generations. Literacy and numeracy rates, meanwhile, offer a vital measure of competencies that are basic building blocks for all future educational achievement.

Internationally comparable data are especially important in this area, because cross-country comparisons naturally occur and result in pressure for improvement of educational standards. Cross-country comparison tables provide an effective mechanism for monitoring progress and creating accountability, as has been shown by the use of existing international comparators.

In practice, however, available output indicators are less robust than they seem, as discussed at length in the following section. There is no accepted international definition of literacy (Puryear, 1995), for example, and grade inflation can undermine the consistency of an examination system. The more robust systems, such as the Trends in International Mathematics and Science Study (TIMSS) and the International Adult Literacy Survey (IALS), cover relatively few developing countries, and countries are not required to make the results public. More broad-based statistical systems, meanwhile, suffer from acute problems of comparability, consistency, and accuracy. The 1998 UNESCO Statistical Yearbook, for example, repeatedly warns users to exercise caution when comparing data across countries (World Bank, 2000).

Outcome Measures

Outcome data are both the hardest measures to track and the most important educational indicators for individuals and societies. The measurement of outcomes includes evaluating whether and how education creates stocks of human capital, and the returns, accruing to either individuals or society, realized on investment in education. Without adequate outcome measures, it is impossible to make fundamental decisions about the value that societies should place on education and the importance it should be given in a world of competing priorities.

The most commonly collected outcome measure attempts to capture increased earning capacity on entering the labor force (see Bloom and Canning, 2004). However, education can have many outcomes beyond direct economic advantage. Education is widely believed to have a positive impact on a range of key issues, including public health and birth rates. In a recent overview of the consequences of increased education, Hannum and Buchmann (2003: 20) find:

> Countries with better-educated citizens tend to have healthier populations, as educated individuals make more informed health choices, live longer, and have healthier children. In addition, the populations of countries with more educated citizens tend to grow more slowly, as educated people are able to lower their fertility. Also convincing is evidence that the expansion of educational opportunities will enhance… the future economic security of the world's most vulnerable children.

Broader outcome measures would include indicators such as the competitiveness of businesses, social and economic equality, foreign direct investment, and enrollment in higher education.

Too often, findings about the non-economic impact of education suffer from being both too general and too specific. On the one hand, they tend to suggest that education in general is a social good, but offer little or no insight on whether some types of education are a greater good than others. On the other, they are often based on limited and small-scale studies, which suffer from problems related to data quality, rigor, and establishing causality.

Ease Versus Applicability

A categorization of the types of indicators used to assess education leads to the recognition of a very rough trade-off between ease of measurement and the applicability of the contribution that data make to a reliable and rich picture of education offered. The measures are categorized as follows:

INPUT MEASURES Enrollment rates Average years of schooling Duration of schooling Attainment rates Completion rates Budgets, salaries, and modes of funding Hours per day (per teacher) Drop-out and repetition rates Total hours in class per student per year Infrastructure of schools Number of schools	**OUTPUT MEASURES** Literacy rates Numeracy rates Standardized test scores Any other measures of competency
PROCESS MEASURES Type of schools Mathematics and science content Civics, history, and ideology content Arts and humanities content Books per capita Teacher training standards Student/teacher ratios Administration/teacher ratios Accreditation practices Administrative organization	**OUTCOME MEASURES** Rate of return on educational investment Improvements in public health Lowering of the birth rate Impact on governance, corruption, etc. Competitiveness of businesses Social and economic equality Foreign direct investment Enrollment in higher education

Although inputs are among the easiest indicators to measure and offer some information about the quantity of education available, they are insufficient for assessing the quality of education. Processes are describable in general terms but are often difficult to quantify and compare. Real outputs and outcomes from education are sometimes hard to capture and in some instances can only be assessed indirectly. The most reliable datasets cover relatively few developing countries, and those countries that are furthest from achieving universal education are also those with the least available information on the current state of their education systems. These problems can be more clearly seen in the discussion of what data are currently collected and the exploration of their quality.

WHAT IS COLLECTED?

> *"Studies have typically relied on school-enrollment ratios or adult literacy rates that do not correspond to the stock of human capital that influences current decisions about fertility, health and so on."*
> —Barro and Lee, 1996

This section sets out current education indicators, examines the way they are gathered, and discusses strengths and weaknesses in the available data (see Table 1 for some basic information about each indicator).

This section first provides an outline of the measures of educational access collected by UNESCO—the primary source of global education data. It then looks at attainment and completion information that can be gleaned from UNESCO and other related datasets.[11] It also examines a number of indicators of educational quality. These measure literacy—the International Adult Literacy Survey (IALS), the Progress in International Reading Literacy Survey (PIRLS), and the Program for International Student Assessment (PISA); numeracy—the Trends in International Mathematics and Science Study (TIMSS) and PISA; and science—TIMSS and PISA. Although they offer encouraging possibilities for benchmarking between countries, these measures cover only a limited number of countries. They have little to say about those parts of the world that are furthest from reaching universal education.[12]

Indeed, taken together, the indicators discussed in this paper are weak with respect to the provision of universal education. Data on gender equity are substantial, but comparisons that highlight racial and ethnic disparities and the different circumstances faced by urban and rural students are scant. Because these differences are likely to be great, the lack of data on them significantly impedes any complete understanding of the resources and actions required to extend a high-quality education to all.

UNESCO Data

UNESCO is the primary international source of information about education at all levels. UNESCO's Institute for Statistics (UIS), founded in 1999, collects and organizes information on pre-primary, primary, secondary, and tertiary

11. Demographic and Household Survey data may also be of some use in assessing educational access and attainment. Detailed discussion of these data, however, is beyond the scope of this paper.

12. This paper focuses on the three most widely cited studies of educational outputs. There are, of course, many others, which are not reviewed here, in the interest of tractability. A useful compendium of studies on cross-national surveys appears in Porter and Gamoran (2002).

Table 1: Databases Measuring the Quantity and Quality of Education

Database	UBASE-related Indicators Included	Years for which Data are Collected	Years for which Data are Projected	Countries Included	How to Obtain
UNESCO	Primary GER, Secondary GER, GER by gender, Primary NER, Secondary NER	1970–2005, although different indicators cover differing ranges of years	None	200+	http://www.uis.unesco.org/
Barro-Lee	Completion rate, Attainment rate	1960–2000 (five-year intervals)	None	129	http://www.worldbank.org/research/growth/aer96bl.htm http://www.worldbank.org/research/growth/ddbarle2.htm
Cohen-Soto	Completion rate, Attainment rate	1960–2000 (ten-year intervals)	2010	95	via OECD
Bruns, Mingat, and Rakotomalala	Completion rate	1990–2000	2010–2050	155	Book contains a CD that includes all of the data.
International Adult Literacy Survey (IALS)	Literacy	1994, 1996, 1998	None	About 30	http://www.nald.ca/nls/ials/introduc.htm
Progress in International Reading Literacy Survey (PIRLS)	Reading ability	2001, 2006 (forthcoming)	None	35 (in 2001)	http://nces.ed.gov/surveys/pirls
Program for International Student Assessment (PISA)	Reading ability; math and science understanding	2000, 2003, 2006 (forthcoming)	None	41 (in 2003)	http://www.pisa.oecd.org/
Trends in International Mathematics and Science Study (TIMSS)	Math and science understanding	1995, 1999, 2003	None	49 (in 2003)	http://timss.bc.edu/timss2003.html

education, and provides data on education expenditure and students studying overseas. This overview focuses on the three categories that are most relevant to UBASE: primary indicators, secondary indicators, and education expenditure data.

In 2003, UNESCO initiated a new annual digest of education statistics (UNESCO-UIS *Global Education Digest* 2003, 2004, 2005). Data are collected according to the International Standard Classification of Education (ISCED), which acts as "an instrument suitable for assembling, compiling, and presenting statistics of education both within individual countries and internationally" (UNESCO, 1997). The current classification is known as ISCED 1997 and is named after the year of its adoption. ISCED provides a standard classification for different levels of education, which aims to offer international comparability between education systems that define levels of education in different ways. There are seven ISCED levels (ISCED 0–6), of which three cover primary and secondary education:

- ISCED 1 – Primary education, which is defined as education that gives "students a sound basic education in reading, writing and mathematics" along with an elementary understanding of other key subjects. This stage normally lasts for six years.
- ISCED 2 – Lower-secondary education, which is designed to complete the implantation of basic skills with the aim of laying "the foundation for lifelong learning and human development on which countries may expand, systematically, further educational opportunities." This level normally ends after a total of nine years of schooling and often coincides with the end of compulsory education.
- ISCED 3 – Upper-secondary education, which typically starts at 15 or 16 years of age, and usually involves more specialization than at ISCED 2.

When this report was drafted, UNESCO presented data for three years, 1998/1999,1999/2000, and 2000/2001.[13] For the primary level (ISCED 1), UNESCO provides data on a number of input and process measures:

- The education system – theoretical entrance age, theoretical duration of study, starting ages, and finishing ages for compulsory education
- Enrollment – numbers of students enrolled, with the proportion of girls and a gender parity index and the proportion educated privately; and gross and net enrollment ratios
- Teaching staff – the numbers of teaching staff, percentage of trained teachers, and the pupil/teacher ratio
- Attainment – the proportion of students repeating a year, the survival rates at grades 4 and 5, and a measure of the number of students in the last grade of primary

At the secondary level (ISCED 2 and 3), it publishes data on a similar set of measures:

- The education system – theoretical entrance age and the theoretical duration of study
- Enrollment – enrollment in all programs, with the proportion of girls and a gender parity index; enrollment in general programs and technical or vocational programs; and gross and net enrollment ratios
- Teaching staff – the numbers of teaching staff, percentage of trained teachers, and the pupil/teacher ratio
- Attainment – the proportion of students repeating a year and the proportion of students making the transition from primary to secondary levels

13. The 2005 *Global Education Digest*, the most recent published since this paper was drafted, presents 2002/2003 data.

UNESCO also publishes data covering outputs from the educational system:

- Literacy – literacy rates and illiterate population, including figures for men and women
- Education stocks – percentage distribution of population aged 15 plus or 25 plus, by gender, with educational attainment according to the following categories: no schooling, primary incomplete, primary complete, lower secondary education, upper secondary education, and post-secondary[14]

Finally, the following financing data are available:

- Total public expenditure on education, as a percentage of GDP and of total government expenditure
- Current versus capital public expenditure on education

UNESCO data are compiled from information provided by governments or other relevant authorities. Questionnaires are sent to the UNESCO National Commissions, who forward them to the relevant national authorities (Ministries of Education, Ministries of Finance, the National Library, etc.), or are downloaded from the UNESCO website. The instructions give definitions of all indicators and require that local authorities conform to UNESCO standards in reporting data. The questionnaires are completed by national experts and then returned to UNESCO. At this stage, UNESCO uses national statistical or educational publications to cross check figures, as well as to ensure that there have been no changes in the structure of the country's education system since the last questionnaire was entered into the database. If any inconsistencies in the data presented by the national authorities are noted, UIS contacts the country for clarification. Despite this careful and labor-intensive process, UNESCO has historically faced difficulty collecting any information from some countries, and the quality of information provided by many other countries has been questioned. In some instances, it has proved difficult to ensure comparability of data across countries.

In its discussion of education statistics, the Task Force on Higher Education convened by UNESCO and the World Bank highlighted some of the difficulties of earlier years:

> In the 1998 Statistical Yearbook, UNESCO authors repeatedly warn users of the need to take care when exercising comparisons between countries, and especially across groups of countries. Many of the differences between nations are detailed in charts that demonstrate differing years of educational entry, different years of schooling offered at the various levels, and different requirements about compulsory education. Readers are warned of particular issues, such as the counting of full-time and part-time teachers, which may vary across nations and have a strong and potentially misleading impact on data about pupil/teacher ratios (World Bank, 2000).

14. As discussed earlier, this paper treats attainment and completion as inputs to the education system.

Puryear, meanwhile, focused on the quality of data reported by countries in the 1980s and early 1990s, suggesting that, at that time, twenty to thirty countries suffered "disastrous problems" in generating reliable education statistics, while another fifty suffered "significant gaps and weaknesses in this area." Statistics from five of the world's nine largest countries were then believed to be seriously deficient, while UNESCO staff told him that statistics from nearly half of UNESCO's member countries were unreliable (Puryear, 1995). Since its foundation, UIS has worked to rectify these problems. As a result of intensive work with national and international users and producers of education statistics, it claims that response rates have improved and that indicators (whose definitions are frequently reviewed) are more timely and comparable. Problems still remain, however.

It is possible to examine the nature of the data collected and ask whether UNESCO's efforts are directed toward generating the right kind of indicators. UNESCO defends its focus on relatively simple enrollment-rate measures by pointing out that the development of more complex indicators is often beyond the capacity of poorer countries, many of which struggle to provide UNESCO with even basic information. It argues that progress toward measuring educational processes, outputs, and outcomes must be complemented by "a parallel strategy…that improves and exploits education data which are more readily available and comparable." UNESCO believes these data can provide valuable insights into countries' educational systems and the characteristics of these systems that are amenable to policy change. "This information can inform policies that create more effective, equitable and efficient educational systems… Reporting on the widening of access to education," it suggests, "needs to be alongside an examination of whether this has been achieved at the expense of the quality of the education being received" (UNESCO-UIS, 2003).

In the past, however, critics wondered whether UNESCO's approach did, in fact, lead to indicators useful to policymakers or other audiences. Although the establishment of UIS has improved the quality and relevance of data collected, Puryear (1995) earlier accused UNESCO of adopting a "collect and file" mentality, rather than showing a commitment to "understand and use." As a result, UNESCO presented policymakers with a crude set of statistics that seemed more precise than they were, instead of more developed indicators that would enable policymakers to base their decisions on firm evidence. Behrman and Rosenzweig, meanwhile, underline the tendency for UNESCO data to be used without a clear understanding of the data's limitations. They point out that data they describe as fictional or made-up (i.e., data points from earlier years or inferences) were often used by researchers and policy makers as if these data were as valid as empirical observations (Behrman and Rosenzweig, 1994).

Input Measures: Enrollment

At the time this report was drafted, data availability was problematic; for example, there were numerous countries for which UNESCO did not provide a figure for the primary gross enrollment ratio[15] (arguably the most fundamental input indicator), and the data for secondary education were even more sparse. However, in the newest version (2005) of the *Global Education Digest,* these particular data are essentially complete. UNESCO now publishes both primary and secondary gross enrollment ratios for 96 percent and 95 percent, respectively, of countries with at least 100,000 people.[16] These figures cover 99 percent of all school-age children.

The corresponding figures for net enrollment ratio are much lower, particularly at the secondary level, where there are no data for China, India, Pakistan, or Russia. Commenting on the challenge of calculating net enrollment rates, UNESCO at one point remarked that "it is of concern that [many countries] are unable to provide the data to calculate the indicator [at the primary level] because the building blocks of the indicator (year of age, gender, and grade) represent fundamental information required to manage educational systems" (UNESCO-UIS, 2003). Survival rates, which measure those who reach the fifth year of education, cannot be calculated in numerous countries, and the usefulness of measures of primary completion is bedeviled by a lack of comparability across countries. UIS has stated that it is committed to exploring with countries whether ISCED level 1 should be used as a common standard for measuring primary completion or whether the completion of a fixed number of years of schooling should be used as a standard international benchmark.

Although UNESCO receives more data than in the past, questions still arise about the quality of the information that countries provide. One possible way of evaluating UNESCO data is to compare these data with findings from survey-based instruments such as USAID's Demographic and Health Surveys (DHS) or the World Bank's Living Standards Measurement Study.[17] *Global Education Digest* compares official Kenyan data, as provided to UNESCO, with two DHS surveys in Kenya, and surveys conducted by ILO and UNICEF. Official data show 5 percent of children out of school in 1990, with 35 percent out of school in 1999. DHS surveys show 26 percent of children out of school in 1993, compared to 13 percent in 1998. The ILO and UNICEF surveys show around 26 percent of children out of school in 1998 and 2000 respectively. These highly contradictory findings cannot be reconciled. As UNESCO comments, "further analysis is needed in order to understand why different sources produce such

15. The gross enrollment ratio for a given level of education is the number of children of any age who are registered in school at that level of education, divided by the total population of the appropriate age, expressed as a percentage. This number can be higher than 100 percent. The net enrollment ratio for a given level of education (used more extensively in this paper) is the number of children of the appropriate age for that level of education who are registered in school at that level, divided by the total population of children of the appropriate age.

16. That is, UNESCO publishes a figure for at least one of the last several years.

17. UNICEF makes such comparisons. In its effort to determine how many primary-school-age children do not attend school, it found that survey data suggest that the number is 121 million—considerably higher than other published estimates. UNICEF pointed out that even data collected via surveys may underestimate the number of children who are not in school, because parents may be unwilling to say that their children are not in school (UNICEF, 2003).

different results" (UNESCO-UIS, 2003). Lloyd and Hewett also compare DHS data with UNESCO data, across Sub-Saharan Africa. They argue:

> UNESCO provides an incomplete and sometimes potentially biased picture of progress towards the millennium education goal with the current data derived from country management information systems. Comparisons with data from DHS suggest that fewer children ever attend school than the UNESCO estimates suggest, but a higher percentage of those who do attend eventually complete grade four. Furthermore, gender gaps in school participation are likely to be smaller than implied by UNESCO enrolment estimates (Lloyd and Hewett, 2003).

UNESCO, meanwhile, detailed a number of problems with survey data, including the timing of fieldwork in the school year, which result in inconsistent estimates of school participation, sampling biases, and cultural biases. It argued that international surveys do too little to take account of country-specific conditions and that these efforts "should also be balanced alongside more long-term goals of building capacity within countries to monitor their own educational systems"[18] (UIS, 2003).

Some, such as Bruns, Mingat, and Rakotomolala (2003), have attempted to strengthen UNESCO data by complementing these with data from other sources. Using a recent dataset designed to assess progress toward the Millennium Development Goal of universal primary completion by 2015, Bruns et al. analyze completion rates of primary education in 155 developing countries between 1990 and 2000. They also provide projections for 2015. Bruns and her coauthors collect completion data directly from national education ministries where possible. Only when these data were not available do they rely on data from previous years. Still, the data set is not perfect: the methodology is complicated by differing lengths of the primary education cycle, which lasts for six years in nearly half the countries studied, but differs in the remainder, ranging from three years to ten years. There are also limitations in the accuracy of the data. First, because primary completion rates were not reported in all countries, these must be estimated from the number of students enrolled in the last year of primary school, subtracting the number likely to repeat. Second, dropout rates were not available for many countries, so the completion rates tend to be overestimates. Third, population data are not always accurate, especially for countries for which there were no recent census data, or for countries that recently experienced dislocations such as war or mass migration. However, the study is the most direct effort to date to measure progress toward universal primary completion, and to provide a basis for future monitoring.[19]

18. UIS's work in capacity building includes strengthening National Education Statistical Information Systems (NESIS). Set up in 1991, this program aims to build statistical capacities in Sub-Saharan Africa. UNESCO and UNICEF are also currently working to draw together administrative and survey data.

19. The completion rate data contained in Bruns, Mingat, and Rakotomalala (2003) are not used in the statistical analysis of this paper. Bruns et al. use a definition of completion rate

Input Measures: Education Stocks

Indicators derived from the current education system provide a snapshot of how that system is performing and whom it is serving at a particular time, but they say little about the educational stocks that have accumulated in the population over time. UNESCO reports data in this area, providing figures for the percentage of population with no schooling, incomplete primary, complete primary, incomplete secondary, complete secondary, and tertiary education. In addition, a number of composite indicators exist, which attempt to strengthen UNESCO's figures by filling in missing observations. This paper discusses datasets created by Barro and Lee (2000) and Cohen and Soto (2001), two distinct approaches to devising composite indicators for these measures. The UNESCO, Barro-Lee, and Cohen-Soto datasets are important efforts to build the foundations of knowledge about the most fundamental elements of global educational development.[20]

different from that of the Barro-Lee and Cohen-Soto indicators (though not different from that used by UIS, which supplied some of the data used by Bruns). Bruns et al. write, "The primary completion rate is a flow measure of the annual output of the primary-education system. It is calculated as the total number of students successfully completing (or graduating from) the last year of primary school in a given year, divided by the total number of children of official graduation age in the population." By contrast, Barro and Lee and Cohen and Soto define completion rate as the percentage of people in the total population of a certain age (either 15+ or 25+) that have completed primary education. Thus, Bruns et al. are analyzing a considerably younger population—typically, 11 year-olds—rather than the 15+ and 25+ populations used for other datasets. Although the measure calculated and used by Bruns et al. is important, it cannot be compared directly with Barro-Lee or Cohen-Soto indicators. Indeed, as should be expected, the primary completion rates reported by Bruns are much higher than those reported by Barro and Lee or Cohen and Soto. To ensure that information from Bruns et al. is statistically consistent with that contained in the primary sources for this paper, I correlated the 1990 and 2000 data against the Barro-Lee and Cohen-Soto datasets. The correlation is high. Despite the difference in definition for completion rate, countries that have low completion rates in Bruns et al. tend also to have low completion rates in both Barro-Lee and Cohen-Soto (and conversely).

20. Krueger and Lindahl (2001) conducted several analyses of the information content of country-level education data. For example, they compared average years of schooling in the Barro-Lee data with measures of average education in Kyriacou (1991), and reported simple correlations of 0.86 in levels (for 68 countries in 1985) and 0.34 (for the same countries for changes from 1965-85). Unfortunately, this is not a clear cut comparison insofar as the Barro and Lee and Kyriacou data sets both rely on the same underlying enrollment data, and because the Barro-Lee data refer to the population aged 25 and over whereas the Kyriacou data refer to the workforce. The same concern applies to Barro and Lee's (1993) comparisons of their data with those of Kyriacou and Psacharopoulos and Ariagada (1986). Krueger and Lindahl (2001) also analyzed data derived from the World Values Survey and concluded that measurement error was particularly prevalent for secondary and tertiary levels of school. Schooling data derived from the World Values Survey were, in principle, independent of schooling data in Barro and Lee, but those data only referred to 34 countries and required numerous assumptions about the age at entry into primary and secondary school, and the absence of grade repetition.

Krueger and Lindahl (2001) also explored the implications of measurement error in education for estimates of the effect of schooling on the growth of national income (Pritchett (1997) addressed similar issues). Consistent with the econometric result that the coefficients of regressors that are measured with error (i.e., additive white noise, uncorrelated with the true value of the regressor in question, with any other regressors, or with the

A comparison of results from the Barro-Lee and Cohen-Soto datasets uncovers significant inconsistencies within these indicators, including what are inferred to be negative enrollment rates for certain country–age group combinations, as well as some implausible decadal changes. The review also discusses significant discrepancies between the two datasets. These discrepancies cloud, in some cases considerably, any understanding of trends and patterns in primary and secondary education at the national level. The inconsistencies are worrying, and particularly so where these concern the 15–24 year-old cohort, because information about this group should provide a more up-to-date indicator of the education system's current performance.[21] Examination of these two key datasets suggests that available indicators may be less than robust. The snapshot of current progress toward universal basic and secondary education that follows, and the examination of trends and developments, is, as a result of data limitations and errors, incomplete and tentative.

Barro and Lee produced a series of reports on measures of educational attainment; their latest paper provides figures for the proportion of the population who successfully completed each of seven levels of schooling (no formal education, attended primary, completed primary, attended secondary, completed secondary, attended tertiary, completed tertiary), standardized according to ISCED 97. It also presents figures for average years of schooling. Data are provided at five-year intervals between 1960 and 1995, with projections for 2000, for the adult population aged 25 and over and aged 15 and over. Complete information is provided for 142 countries, with at least one observation presented for another 35. Data are constructed using UNESCO and other census data as a benchmark. 354 observations are available for educational attainment for the population aged 15 and over, spread across 141 countries during the period 1960–1995 (an average of 2.5 survey observations per country, instead of the ideal 8). 375 observations provide data for the population aged 25 and over in the same period, spread across 142 countries (2.6 survey observations per country). An estimation method is therefore needed to supply a considerable number of missing observations. The authors use the perpetual inventory method, where information on enrollment (gross enrollment ratios, adjusted for repeaters) and the age structure of the population is used to estimate flows of enrolled population. These flows are then used, in conjunction with known attainment levels, to determine levels for

equation's disturbance term) will be biased toward zero, they found evidence that measurement error in education severely attenuates estimates of the effect of the change in schooling on GDP growth. Correcting econometrically for measurement error is consequential insofar as it leads to larger estimates of the effect on income per capita of schooling.

21. I devote considerable effort in this paper to analyzing the educational attainment rates of the 15–24 year age cohort. Achievements in that age group reflect recent changes in the education system and are thus, potentially, an excellent indicator of progress or lack thereof. However, I am aware of the limitations of such a focus. In particular, high retention rates result in many younger members of this group continuing to attend primary school; although their education may be progressing, these students will not be counted as having completed primary education. This is particularly a problem in Africa, and hence with the data on Africa. Because I also look at trends over time, it is possible to use these rates to assess progress.

subsequent years. In this manner, full estimates of educational attainment are obtained for most countries from the established figures of one or more years, and from the reasonably complete data on school enrollment ratios.[22]

Cohen and Soto (2001) present a new dataset on educational attainment and completion rates, based on data compiled by national sources, OECD,[23] and UNESCO. They also reported average years of schooling. In contrast to Barro and Lee, their primary concern was to minimize extrapolations from school enrollment data to keep data as close as possible to those directly available from national censuses. Cohen-Soto data split the population into age groups for ten-year intervals from 1960–2000. Missing observations are filled in using backward or forward extrapolation. School enrollment data are used as a last resort, whereas Barro and Lee use enrollment data to fill missing observations in the first instance. Data cover 95 countries, with 119 censuses available (an average of 1.3 per country); 28 countries do not have any censuses available.

Potential problems with Cohen-Soto (as well as Barro-Lee) imputation methods include their lack of accounting for immigration, emigration, and the impact of epidemics. These affect the assumptions of stable population growth and mortality rates. Also, the authors are not confident of their numbers for African countries and exclude them from subsequent econometric analysis in growth models. Krueger and Lindahl (2001), in critiquing Barro-Lee imputation methods, note various problems that stem from UNESCO data: the difference between beginning-of-year registration and ultimate attendance, the varying definitions of secondary schooling across countries, and the compounding of errors through the use of the "perpetual inventory method" of constructing the data.

Although the Barro-Lee and Cohen-Soto datasets provide similar figures for some countries, numerous and substantial discrepancies between the figures for individual countries in each dataset undermine confidence in the data. Additionally, relatively simple calculations of attainment rates for the 15–24 year-old cohort yielded some implausible results, especially in the Barro and Lee dataset (discussed in detail below). This section explores the extent of these irregularities and discusses the possible consequences.

Figures 1 and 2 compare the Barro-Lee and Cohen-Soto data on attainment rates for the population aged 25+. If the two datasets were in perfect agreement, the points on the scatterplot would fall exactly on the one-to-one line through the figure (with an R-squared value of 1). As Figure 1 shows, at the primary level, the Barro-Lee and Cohen-Soto datasets are in agreement for most countries. However, there are discrepancies of over 10 percentage points between the datasets for five countries in the Latin America/Caribbean

22. A definition of the perpetual inventory method, used in the more typical financial context, appears at http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/gl008546.htm.

23. In 1997, and in collaboration with the OECD, UNESCO launched the World Education Indicators (WEI) pilot program, which now covers 19 middle-income countries, including China, Brazil, and India (UNESCO/OECD, 2000). These countries comprise over 70 percent of the world's population.

region, for six countries in Sub-Saharan Africa, and for Jordan, Myanmar, and Indonesia. At the secondary level, Figure 2 shows that although the datasets are in agreement for countries with lower attainment rates, inconsistency increases as attainment rate increases. The figures for the developed world are particularly inconsistent, with discrepancies of over 20 percentage points for eight countries. Figures for most developing countries are in rough agreement, although there are discrepancies of over 10 percentage points in seven countries.[24]

This study also calculated the attainment figures for the cohort aged 15–24 years. These were calculated by extrapolating from the figures reported by Barro and Lee and Cohen and Soto for the 15+ and 25+ age groups in each country, using the size of each country's population, reported by the United Nations Population Division for each five-year age group for five-year intervals since 1950. Parallel calculations were performed on both datasets to yield the attainment figures by gender and the completion rates for primary education.[25] Although these calculations are straightforward, the accuracy of the results depends on the accuracy of the population figures.[26] Discrepancies between datasets are in some cases larger, and are found more frequently, between the extrapolated figures than between the attainment data in the datasets. For example, for primary attainment in the Dominican Republic, estimates differ by 9 percentage points for the 25+ group but by 45 percentage points for the 15–24 cohort. Among the estimates of secondary attainment in developed countries, there are differences of more than 50 percentage points between the datasets for Denmark and France in the 15–24 year-old cohort.

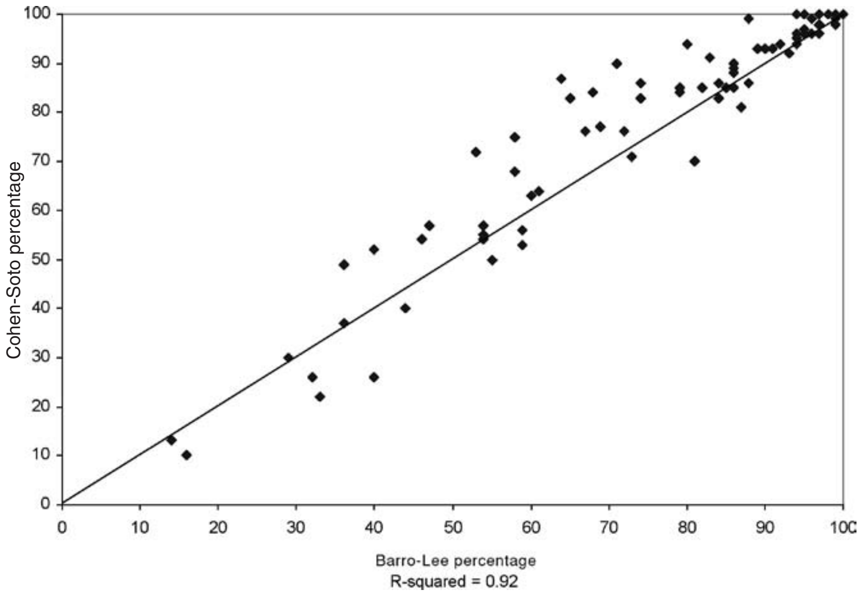
Additionally, there are discrepancies in the estimates for secondary attainment in Colombia, Guyana, and Malaysia of 13, 7, and 0 percentage points respectively in the 25+ age group, but of 28, 34, and 68 percentage points respectively in the 15–24 age group (with figures higher in the Cohen-Soto dataset). The figures for South Africa are still more inconsistent: 19 percentage points higher in Barro and Lee's estimate in the 25+ age group, but 85 percentage points higher in Cohen and Soto's estimate in the 15–24 age group.

24. The complete, country-level data on primary and secondary attainment from the Barro-Lee and Cohen-Soto datasets are available on the UBASE website, http://www.amacad.org/projects/ubase.aspx.

25. These data—primary and secondary attainment, primary completion, and attainment by gender—calculated for the 15–24 year-old cohort, are available in full on the UBASE website, http://www.amacad.org/projects/ubase.aspx.

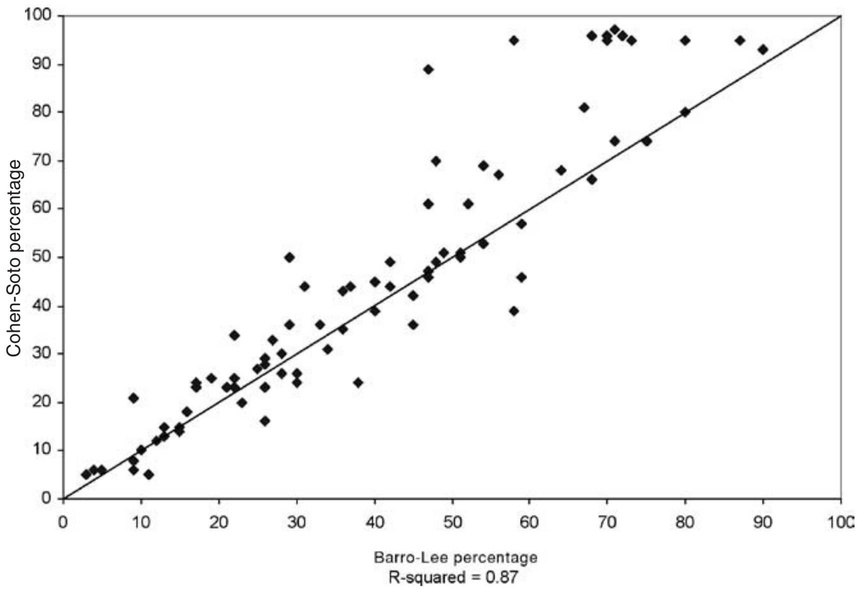
26. As an example of these calculations: In Argentina in 2000, Barro and Lee give secondary attainment rates of 51.2 percent for the 15+ age group and 44.6 percent for the 25+ age group. From the UN figures, the 15+ population is 26.8 million, and the 25+ population is 20.2 million, so the 15-24 population is 6.6 million. To determine the number of people in that age group with secondary level attainment, I calculate how many in the 15+ and 25+ age groups have secondary attainment, by multiplying the attainment rate by the population size. For the 15+ group, this is 51.2 percent of 26.8 million (13.7 million): for the 25+ age group, the result is 9.0 million. By subtracting, I find that 4.7 million people have secondary attainment in the 15–24 year age group. Dividing by the population size of 6.6 million gives a secondary attainment rate of 71 percent.

Figure 1: Comparing Datasets: Primary Attainment Rates, Population Age 25+



Sources: Barro and Lee (2000) and Cohen and Soto (2001).

Figure 2: Comparing Datasets: Secondary Attainment Rates, Population Age 25+



Sources: Barro and Lee (2000) and Cohen and Soto (2001).

Another, more significant irregularity appears in the secondary attainment data from Barro and Lee. In Singapore in 2000, the secondary attainment rate reported for the 25+ population is 59 percent. For the 15+ population, the figure given (but not shown in the Appendix of that paper) is 45 percent. It seems unlikely that secondary attainment rates would have decreased in Singapore in the most recent generation, and indeed they did not do so in

1960, 1970, 1980, or 1990. The 25+ population in 2000 in Singapore was approximately five times larger than the 15–24 population. Following the methods described above, I calculated a secondary attainment rate in the 15–24 cohort of -32 percent, which is by definition impossible. This leads to the conclusion that the underlying data are incorrect, though the population data in Singapore for 2000 seem unlikely to contain large errors. Although a negative attainment value for the 15–24 year-old cohort was detected only in Singapore, there may nevertheless be errors in the data for other countries, which were not detected because they led to low positive values for this age group rather than to negative values. There is no obvious way to distinguish such results, and they would routinely be included in calculations of regional and world averages, distorting the results. These considerations cast doubt on the validity of the Barro and Lee data for attainment rates.[27]

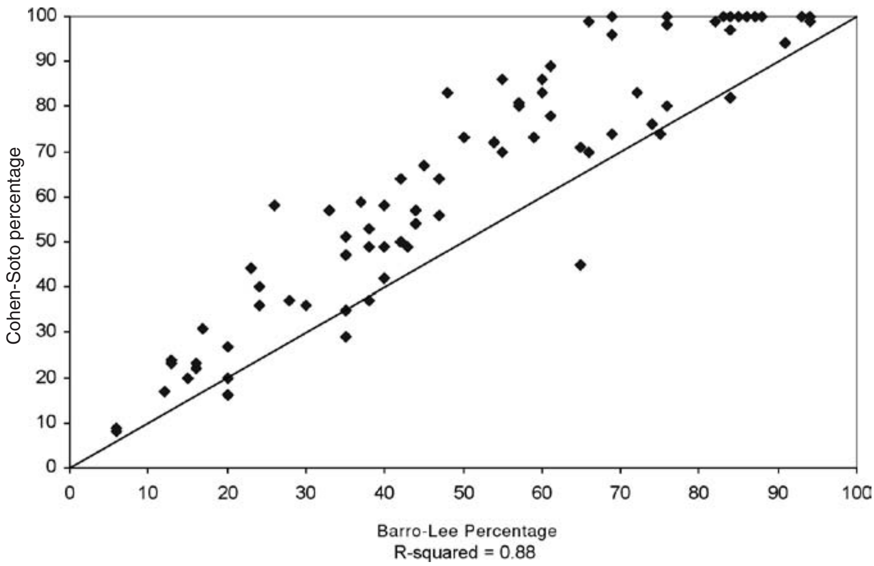
In the data for primary completion rates for the 25+ group, there are a number of significant differences between the two datasets, as Figure 3 shows. In developing countries, discrepancies are particularly large for Guyana (31 percentage points higher in the Cohen-Soto dataset) and Thailand (35 percentage points higher in the Cohen-Soto dataset). Data for secondary education are compared in Figure 4, which shows that estimates are substantially higher in the Cohen-Soto dataset for several developing countries, notably Hungary (by 28 percentage points), Guyana (by 24 percentage points), Trinidad and Tobago (by 24 percentage points), and Zimbabwe (by 22 percentage points). There are also major inconsistencies among developed countries, with estimates over 20 percentage points higher in the Cohen-Soto dataset for five countries, the largest of which is in the United Kingdom (43 percentage points).

In general, the data from the Barro-Lee and Cohen-Soto datasets on trends in primary and secondary attainment in the 25+ age group are more consistent between sources.[28] However, some of the shifts from one decade to the next are large and difficult to believe. Because membership in the 25+ population does not vary dramatically from one decade to the next, changes in these figures should be relatively minor. Kuwait seems to have decreased its primary attainment rate by 8 percentage points during the 1970s, perhaps related in some unexpected fashion to the first oil price shock. In the Barro-Lee dataset for primary attainment, Senegal and Sri Lanka have particularly unlikely patterns, and Mozambique's pattern in the Cohen-Soto dataset is questionable. The pattern for secondary attainment in Barbados in the Barro-

27. I did not examine the parallel question regarding completion data for secondary education. Secondary completion data for the 15+ age group are necessarily (and correctly) skewed downward, because, in most countries, students do not complete secondary education until approximately age 17. Therefore a small portion of the 15+ age group, rising to approximately one-third in the 15–24 cohort, cannot reasonably be expected to have completed secondary education. However, this caveat does not affect the calculation of secondary attainment rates in the 15–24 age group.

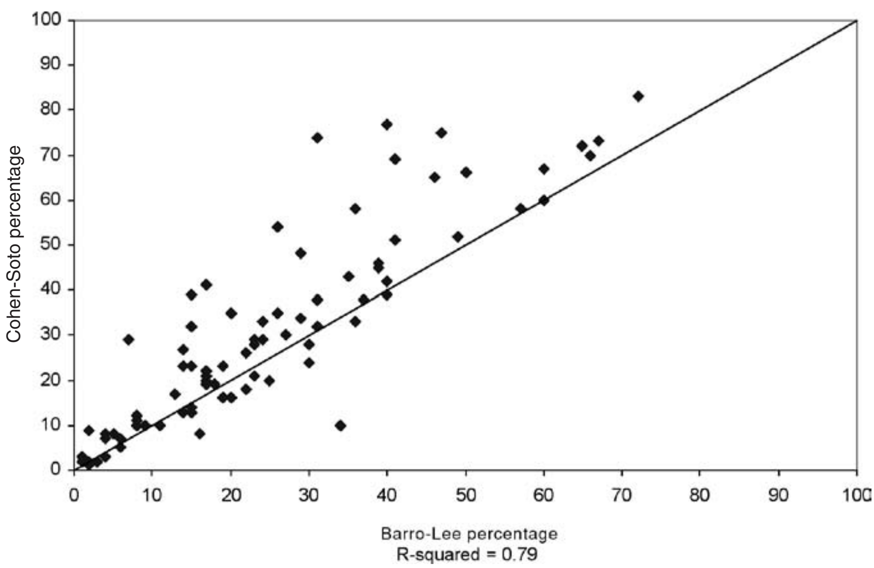
28. These decadal trend data from both datasets on primary and secondary attainment are available on the UBASE website, http://www.amacad.org/projects/ubase.aspx.

Figure 3: Comparing Datasets: Primary Completion Rates, Population Age 25+



Sources: Barro and Lee (2000) and Cohen and Soto (2001).

Figure 4: Comparing Datasets: Secondary Completion Rates, Population Age 25+



Sources: Barro and Lee (2000) and Cohen and Soto (2001).

Lee dataset is quite obviously incorrect. Additionally, there are a few discrepancies between datasets. Notably, the Barro-Lee figures for primary attainment in El Salvador are 8, 18, -2, and 3 percent for each decade. The figure of -2 may be explained by the civil war in El Salvador in the 1980s. However, the Cohen-Soto dataset gives corresponding figures of 5, 9, 16, and 12 percent.

Despite their many gaps and inconsistencies, input indicators currently provide the broadest international coverage of any available measures. Nevertheless, input indicators only provide part of the story; to assess education systems' effectiveness, output indicators must be considered.

Output Measures: Testing of Educational Quality

Work to measure education quality across countries has principally been carried out by the International Association for the Evaluation of Educational Achievement (IEA) and the OECD.

IEA was set up in 1958 "to conduct large-scale comparative studies of educational achievement, with the aim of gaining a more in-depth understanding of the effects of policies and practices within and across systems of education."[29] Although its membership is dominated by developed countries, it does have a number of developing country members, including four African countries—Botswana, Kenya, Nigeria, and South Africa. Member and non-member countries are able to join IEA studies, but a considerable degree of institutional sophistication is needed for participation. Countries must appoint a National Study Center, a National Research Coordinator, and a National Committee with expertise in curricula and educational policymaking and in the technical design and implementation of the study. Countries are required to meet all costs incurred in their national study and to contribute to costs incurred internationally. IEA has conducted 15 cross-national studies since its inception. Its current major studies include the Trends in Mathematics and Science Study (TIMSS 1995, TIMSS 1999, TIMSS 2003, and the planned TIMSS 2007) and the Progress in International Reading Literacy Studies (PIRLS 2001, and the planned PIRLS 2006). These tests had a number of forerunners, such as the First International Science Study and the First International Mathematics Study (Husén, 1967; Walker, 1976). The contribution from countries to participate in these assessments is relatively modest. TIMSS 2003, for example, which has funding from the United States National Center for Education Statistics, the National Science Foundation, the World Bank, and the United Nations Development Programme, requires a donation over a three-year period of $40,000 per year for one grade level and $60,000 per year for two grade levels.

TIMSS represents IEA's most sustained attempt to measure mathematical and scientific achievement. It is directed at children in the fourth and eighth grades (or the grades with the greatest proportions of 9 year-old and 13 year-old students, respectively). In 1995, 42 countries participated in the eighth-grade study and 27 in the fourth-grade study. In 1999, 26 of the original countries took part in a second assessment of eighth-grade achievement and were joined by 12 additional countries. 53 countries and regions took part in the 2003 study,[30] including sub-national units with distinct educational sys-

29. As described by UNESCO, at http://portal.unesco.org/education/en/ev.php-URL_ID=34283&URL_DO=DO_TOPIC&URL_SECTION=201.html.

30. In 2003, 30 low- and middle-income countries participated: Argentina, Armenia, Botswana, Bulgaria, Chile, Egypt, Estonia, Ghana, Hungary, Indonesia, Iran, Jordan, Latvia, Lebanon, Lithuania, Macedonia, Malaysia, Moldova, Morocco, Palestinian

tems (Flanders, the Basque Country, England, the state of Indiana in the United States, etc.). This feature differentiates TIMSS from the UNESCO data-collection system (IEA *TIMSS*, 2003). The study reported at the end of 2004.

At the heart of the study are the TIMSS tests, which ask students a number of multiple choice and open-ended questions. For mathematics, the tests are framed by a content dimension (numbers, algebra, measurement, geometry, and data) and a cognitive domain (knowing facts and procedures, using concepts, solving routine problems, and reasoning). According to the IEA, "The content domains define the specific mathematics subject matter covered by the assessment, and the cognitive domains define the sets of behaviors expected of students as they engage with the mathematics content." For science, the tests are similarly framed by a content dimension (life science, chemistry, physics, earth science, and environmental science) and cognitive dimension (factual knowledge, conceptual understanding, and reasoning and analysis). TIMSS also asks students, teachers, and school principals to complete questionnaires about "the contexts for learning mathematics and science" (IEA *TIMSS*, 2003).

It is not possible to test all students on all content, as IEA estimates that a full test would take seven hours at the eighth-grade level and five and a half hours at the fourth-grade level. Eighth grade students therefore answer only a subset of TIMSS questions that takes 90 minutes to answer; fourth grade students answer a set of questions designed to take 65 minutes. Each student has an additional 15–30 minutes to answer the accompanying questionnaire. Countries are expected to test a sample of at least 4,500 students to ensure that enough students take each part of the test. Responses to each part are then combined to provide an overall picture of the country's performance, in a format that allows accurate comparison with the performance of other countries (IEA *TIMSS*, 2003). Tests are prepared in English, but then must be translated (into 43 languages in 2003) and modified for cultural reasons. Training manuals support the testing procedure, and further procedures are required to ensure quality control and consistent scoring, especially for open-answer questions. The study ranks performance in mathematics and science, and tracks improvements over time (through comparisons with earlier versions of the test) and differences in performance by gender. Responses to the questionnaire are used to assess student attitudes toward each subject, the way national curricula are developed, the proportion of time in school dedicated to each subject, and the main pedagogical methods employed. Findings from TIMSS 1999 are discussed in more detail in Section 2.[31]

The organization of PIRLS is similar, in many regards, to TIMSS. It assesses reading achievement at the fourth-grade level, or the grade that contains the largest proportion of 9 year-old children. Perhaps most significantly, "the tar-

Authority, Philippines, Romania, Russian Federation, Saudi Arabia, Serbia, Slovakia, South Africa, Syria, Tunisia, and Yemen.

31. Results for TIMSS 2003 are now available; however, at the time this paper was drafted, TIMSS 1999 was the most recent available study.

get grade should represent that point in the curriculum where students have essentially finished learning the basic reading skills and will focus more on 'reading to learn' in the subsequent grades" (IEA, 2003: 286). PIRLS also collects information on the home, school, and national context within which children learn to read. The first assessment was conducted in 2001, and follows earlier IEA studies in the area in 1970 and 1991. A second assessment is currently being developed for 2006. 35 countries participated in the study in 2001, while various developing and middle-income countries[32] have expressed interest in participating in 2006.

The assessment framework for 2001 focused on three aspects of reading: processes of comprehension, purposes for reading, and reading behaviors and attitudes. PIRLS developed eight passages and accompanying comprehension questions, and students responded to two passages each in a test lasting 80 minutes. An additional 15–30 minutes were allocated to the student questionnaire. Tests were prepared in English and translated into 31 languages; the extensive translation effort included statistical checks to detect elements within the test that did not perform comparably in translation. As with TIMSS, PIRLS provides rankings of reading achievement, disaggregated by gender, and an assessment of contextual issues such as the role of home activities in fostering literacy, the nature of curriculum and school organization, the methods used to teach reading and the support provided by schools, and information on students' attitudes and reading habits.

PIRLS and TIMSS test basic skills as a student moves through the school system. PISA—run by OECD—takes a different but complementary approach, emphasizing competencies at the end of compulsory education. OECD describes the assessment as "forward-looking: rather than focusing on the extent to which these students have mastered a specific school curriculum, it looks at their ability to use their knowledge and skills to meet real life challenges" (Adams and Wu, 2002: 15). PISA is to be run every three years. Numerous developing and middle-income countries were involved in PISA 2000 and 2003.[33] Each country tested between 4,500 and 10,000 students.

PISA surveys reading, mathematical, and scientific literacy. In 2000, the primary focus was on reading. Mathematics was the primary focus in 2003, and science will be the focus in 2006. Multiple choice, short answer, and extended response questions are included. A student and school questionnaire are also used, although not all countries took up this option in 2000. Used to make international comparisons of reading, mathematics, and science, the questionnaires also allow PISA to report on the impacts of engage-

32. These include Albania, Belarus, Bulgaria, China, Czech Republic, Hungary, Indonesia, Iran, Latvia, Lithuania, Macedonia, Moldova, Morocco, Nicaragua, Poland, Romania, Russian Federation, Slovakia, Slovenia, South Africa, and Zimbabwe.

33. These include Albania, Argentina, Brazil, Bulgaria, Chile, China, Czech Republic, Hungary, Indonesia, Latvia, Macedonia, Mexico, Peru, Poland, Romania, Russian Federation, and Thailand. Serbia, Slovakia, Tunisia, Turkey, and Uruguay joined the study for PISA 2003, though several former participants, including China, did not participate.

ment, family background, and school characteristics on learning. The study disaggregates a range of factors that it believes explain differential performance between countries and schools, and attempts to quantify their relative importance. OECD suggests these factors include socioeconomic background, school resources, school policy and practice, and classroom practice, though it suggests that further research and analysis are needed to identify more precisely how these factors operate. OECD maintains that its approach will provide policymakers, parents, and students with more accurate information about what educational policies and practices work and why, as well as the extent to which countries are able to develop educational systems that make the most effective use of continually limited resources.

Prospects for International Comparisons

The development of indicators such as PIRLS, TIMSS, and PISA, which allow comparisons across international education systems, is relatively recent. Each is, to at least some extent, a cooperative venture among governments or other relevant educational authorities, and requires considerable commitment from participating countries. This is both a strength and a weakness. On the one hand, the commitment required suggests that participants expect to receive results that will be immediately relevant to the development of their educational systems. There is unlikely to be any tendency to "file and forget" these indicators, and there will be ongoing pressure from participants to increase relevance and applicability. On the other hand, those countries that are furthest from achieving universal education are also likely to be those with the least incentive to participate. They lack resources and capacity, and may also find more unwelcome evidence of their educational failings. These disincentives will not disappear quickly, and researchers and policymakers will likely continue to be hampered by a lack of data.

The participation of some developing countries in these assessments shows the potential to gradually increase the reach of international assessments. Recent research in the developing world suggests "a global trend toward greater use of assessment" (Braun and Kanjee, 2006), but also concedes that participation in studies like TIMSS and PIRLS is "a political decision…not taken lightly…because of concern about the consequences of poor performance" (Braun and Kanjee, 2006). Although assessments are unlikely ever to be conducted in states that face catastrophic educational deficits or widespread systemic breakdown, many countries may choose to adopt these assessment systems as they increase investment in their educational systems. It is to the advantage of donors to encourage participation, to evaluate the effectiveness of their investments.

Unfortunately, any move toward greater use of international assessments will have to take into account concerns about the information content of assessments, at least as they are currently conducted. Braun and Kanjee (2006) point out that assessment data are not necessarily very reliable and may not have been gathered in valid ways. Factors unrelated to the education system itself, such as uneven participation in exam-preparation courses within countries, can affect results, and some students may not perform well on standardized tests even if they possess the relevant information.

Gradstein and Nikitin (2004) note other significant problems with using standardized tests as measures of school quality. For a given country, mastery of foreign languages or knowledge of history could be a more important focus of the education system and therefore a better indicator of quality than measures of literacy, science, and math. They add, "Schooling may instill social norms, develop work habits, and inculcate values…As has been noted in the literature, these factors may have various beneficial effects, such as on crime reduction, better informed fertility choices, political participation, etc" (2004: 3).

DOES IT MATTER?

> *"Not everything that can be counted counts, and not everything that counts can be counted."*
>
> —Albert Einstein

Commentary on the current shortcomings of international educational data can be separated into three types. Puryear identifies the first of these as an ideological belief that education is unquantifiable and that attempts to measure it "miss the point of what education is all about" (1995: 87). Although education is hard to measure, as the above analysis would suggest, it seems that this particular objection to measuring the quantity and quality of schooling is being eroded by mounting evidence of a relationship between education and development. Moreover, the difficulty in quantifying educational inputs and outputs does not mean that the endeavor is useless. Indeed, what has already been learned from tracking the consequences of increased education indicates that there are good returns on investment as well as private and public returns to health, gender equity, and income.

A second argument is that a lack of capacity and expertise is partially responsible for the variable quality of educational data. Lievesley (2001) points out that international statisticians are "constrained in what they can do about the quality of the data they receive." She explores the importance of capacity building to improve statistical skills in developing countries, and their potential to raise the quality of international data. As UNESCO argues, "The development and implementation of new indicators require time and national expertise, and these resources have to be balanced against those that support more immediate requirements for data. Trade-offs are inevitable, especially when many countries are still struggling to produce even the most basic monitoring information about their educational systems" (UNESCO, 2003). The UNESCO Institute for Statistics is developing several new indicators in the areas of literacy, adult education, measures of primary completion, early childhood, life skills, and out-of-school children.

Third, many argue that comparisons of educational inputs, processes, outputs, and outcomes across countries can be politically embarrassing and unpopular. In some cases this situation may lead to pressure to inflate statistics when they are provided for studies. For example, Jean Drèze and

Amartya Sen (1995) refuse to use official data in their analysis of economic development in India, partly because of the incentive to government employees to report exaggerated figures. They compare data from the census and a National Sample Survey that suggest that only 40–42 percent of rural girls between ages 5 and 14 attend school, although official statistics state a gross enrollment rate of 98–99 percent. These points suggest that incentives work against the production of high-quality data on education.

Pressure to focus more resources on data and data analysis comes from a number of sources, including policymakers, investors, and those who use the educational system, and works through a number of pathways. Leaders and policymakers need data to make the case for educational investment and to direct that investment toward types of education that will have the greatest impact on an individual or society's future. Likewise, efforts to set goals for educational development at national and international levels require data both to set reasonable goals and to measure progress toward meeting these goals.

Data are essential to developing sound investment policies. Education programs may require evaluations of the effectiveness of new and existing investment in education, whether the investment is provided at a national level or contributed by international donors. In addition, more effective process information about the educational system allows limited resources to be deployed to greatest effect.

Demand can also come from the users of educational systems and the taxpayers who largely fund them, as internationally comparable data allow pressure to build for reform and increase accountability. Parents and students may also demand the publication of information that allows them to make informed choices among educational options offered.

Although most primary and secondary education continues to be purchased by governments, using public money, the chain of consumption is extended. It includes the state and its citizens, as well as parents and students. These groups have overlapping roles and interests in both the quantity and the quality of education, but none has absolute and clear responsibility for making decisions about when and whether to purchase education. Better information about the quality of education available helps all three groups in their decision making. For governments, accurate and comparable data enable robust assessment of the cost-effectiveness of the school system and evaluation of inputs and processes, and they provide for citizens some measure of how successfully taxes are being deployed. For parents and students, information about the quality of education may, depending on the design of the local system, help them to exercise choices that provide an impetus to improve quality across the board.

From the perspective of achieving universal basic and secondary education, a small set of indicators may be the most useful and applicable:

- Inputs: indicators of financing available for education (and its distribution); attendance figures at all stages of primary and secondary education to allow for trends in access to be accurately monitored

- Process: indicators that provide policymakers with a greater understanding of how schools can most effectively support desired learning outputs class sizes and teacher qualifications, for example, are important indicators that are relatively easy to measure)
- Outputs: measures of educational completion; international benchmarks of educational quality, especially focusing on the development of basic "building block" skills (reading, mathematical, and scientific literacy) and the development of desired competencies
- Outcomes: analyses showing the degree to which universal access will improve the health of a population, lower the birth rate, and enhance the economic prospects of poor children (Hannum and Buchmann, 2003; Bloom and Canning, 2004; and World Bank, 2000)

Of course, better information on educational outcomes will continue to provide a broad context for efforts to achieve UBASE by allowing governments, parents, and students to better understand the impact education has on individual lives and the effect that full primary and secondary schooling is likely to have on countries as they become increasingly highly skilled and knowledge rich.

Finally, it is important to recognize that even pervasive problems in the data on education do not make such data worthless—far from it. First, even very rough data can be useful if they shed some light on the concept they are intended to measure. For example, enrollment rates are clearly connected with countries' experiences in giving children access to education. Large disparities between one country and another likely indicate genuine differences. All of the indicators discussed in this paper are useful for understanding the state of education, and they shed light on the direction in which countries need to move if they are to improve the quantity and quality of education. The disquieting problems cited above suggest that one should be cautious in reaching specific or narrow conclusions. Nevertheless, many of the trends indicated by these data are so overwhelming as to be indisputable.

The Current State of Education Worldwide

This section of the paper sets out a snapshot of current global, regional, and national access to, engagement with, and outcomes from primary and secondary education. It examines three of the core sets of indicators of educational quantity, including both input and output measures, currently available to policymakers: UNESCO enrollment data and the Barro-Lee and Cohen-Soto datasets on educational attainment and completion.[34] It also analyzes recent progress toward achieving universal access to basic and secondary education, regionally and by gender, and considers some of the instruments designed to measure educational quality that are currently available and the insights these have provided.

First, I examine current net enrollment rates at the primary and secondary levels, using UNESCO data. This fundamental input measure is compared between countries and regions, to identify areas where progress toward universal enrollment is relatively strong and areas that lag behind the rest of the world.[35] Enrollments are also analyzed for gender disparity, to identify regions where girls continue to have significantly reduced access to education.

To enrich the global picture of education, the section examines data and trends in educational attainment (i.e., the percentage of children that have attended at least some of a given level of education), and completion of educational levels. It uses data from Barro and Lee and Cohen and Soto, which are described alongside other key indicators in Table 1. As a result of problems arising between the Cohen-Soto and Barro-Lee datasets, the snapshot of current worldwide progress toward universal access to primary and secondary education as presented here is necessarily partial and tentative.

Attainment and completion information, taken from the Barro-Lee dataset for 2000, and Cohen-Soto for 2001, with further comparisons against recent UNESCO information[36] is analyzed using methods similar to those used

34. As noted, despite the problems detailed above regarding the Barro-Lee and Cohen-Soto data, these datasets can still be useful, but conclusions derived from them must be handled with caution.

35. Net enrollments (see footnote 15 for definition) are limited in the information they can offer, however. Net enrollment data may still include a large number of repeaters; for example, in Brazil, 26 percent of primary school children repeated their grades in 1997, and on average, Brazilian students repeat over two years of classes, which accounts for around one third of the average total time spent in school in the mid-1990s (Bloom and Cohen, 2002). Second, enrollment is an input, and therefore not necessarily linked to any educational outputs and long-term outcomes. Many children may be present to register at the start of the school year but never return to school again.

36. Percentage distribution of population by educational attainment, UNESCO Institute for Statistics, December 2002.

for UNESCO enrollment data. First, regional comparisons produce a basic picture of lagging and leading regions and countries, with respect to attainment and completion at the primary and secondary levels. Second, an analysis of gender disparity using Barro-Lee data adds to the enrollment-based information on gaps in educational access between boys and girls.

Series data for attainment and completion are further manipulated to produce information about trends in average attainment and completion rates since 1960, although much of this material is patchy and fraught with problems. The analysis later focuses specifically on trends in, and predictions for, low-income and low-attainment countries, where much work must be focused if universal access to basic and secondary education of good quality is to become a reality.

However, attainment and completion data do not measure skills obtained in school, and in particular give no indication of differences between countries in the quality of education available. This section therefore also includes information on the acquisition of core skills, as measured by the TIMSS 1999 and PIRLS 2001 programs at the primary level, and evidence of literacy, numeracy, and scientific understanding in 15 year-olds from the PISA 2000 dataset.

These data on quality contain some insights and provide greater context, particularly for some countries in developing regions where quantitative indicators suggest excellent progress toward universal education, at least at the primary level. However, the small-scale nature of these studies, and their concentration amongst OECD and developed countries, means that global conclusions on quality of education are impossible to develop, because most of the developing world is not represented within them.

NEW ESTIMATES

Before focusing on education trends in specific countries and regions, it is helpful to first estimate the overall level of global educational access. A description of how the estimates for current and 2015 enrollment levels were made can be found in Appendix B. My calculations suggest that, judging by official enrollment statistics and UN population data, roughly 97 million children of primary school age and 226 million children of secondary school age (15 percent and 30 percent of the children in the world of those age groups, respectively) do not attend school.

A separate set of calculations leads me to estimate that if enrollment rates continue to change at the pace they did between 1990 and 2002, then, in 2015, 114 million children of primary school age will not be enrolled in school and 185 million of secondary school age will not be enrolled (17 percent and 24 percent of the relevant populations, respectively).[37]

37. The finding that recent rates of improvement in primary enrollment do not lead to predicted improvement in 2015—indeed, I foresee a worsening of the problem—probably results from offsetting factors such as rapid population growth in countries that are off track to meet education goals. In a positive direction, one would expect recent improvements to lead to fewer (or at least a lower percentage of) non-enrolled students in 2015. In

An overall assessment of the quality of education can be made across a sample of 113 countries, using recent data and projecting data for 2015. The primary-age population for these countries in 1998 is approximately 640 million. Of this population, only about 33 to 34 million (5 percent) live in countries that score at or above the OECD level, using either TIMSS science or TIMSS math scores as the baseline. Using PIRLS as the baseline, approximately 155 million children (24 percent) live in countries scoring at or above the OECD level.

Projections for 2015 show a virtually unchanged quality divide. The relevant population grows to around 655 million children of primary school age. With TIMSS science as the baseline, about 32 million (5 percent) live in countries scoring at or above OECD levels (taking into account the fact that the OECD level will rise over time, as well). For TIMSS math and PIRLS, the numbers are approximately 28 million (4 percent) and 155 million (24 percent), respectively.[38]

NET ENROLLMENT

Overview

UNESCO data on net enrollments in primary education show that although total global progress toward universal access, as evidenced by this fundamental measure, is strong, several regions and many individual countries lag the rest of the world, some significantly. In some cases, equality of access to primary education is also a serious concern, particularly in those countries and regions where overall enrollment levels are relatively low.

the other direction, countries with fast-growing populations are often those with a range of socioeconomic problems and that have struggled with primary enrollment over many years; absent major changes, these struggles will continue. These factors combine to more than offset progress in other countries. The modest improvement predicted for secondary education may stem from the fact that secondary education enrollment rates are currently much lower than primary enrollment rates. In recent years, it has been easier to make significant progress where there is a further distance to the desired goal.

38. To arrive at these estimates, I first regress country test scores on life expectancy and primary net enrollment. Life expectancy figures are from UN data, and test scores are from the organizations cited in this document. Using this regression, I generate a larger set of fitted values for countries with known net enrollment rates and life expectancies but in which students had not taken the standardized tests. For the sake of comparison, I fit all values, even for countries that had taken the test (so that I did not compare incompatible true values and fitted values). I then average the fitted scores for countries within the OECD, generating a "high quality" score. Using population data from the UN, I find the relevant population for each country (assuming primary schooling age of 6–11). Finally, I count the number of children living in countries where fitted values are at or above the OECD average, in an attempt to quantify the quality divide between rich and poor countries. Using the original regressions, projected net enrollment rates, and projected life expectancy figures, I make the same calculations for 2015. Projected life expectancy figures are from the UN. Projected net enrollment rates are calculated under the assumption that the change in enrollment rates between 1990 and 2000 is a good predictor of future change. In the case where 1990 or 2000 data are unavailable, the nearest year(s) possible are used in the calculation.

Further, many of the countries where the most progress needs to be made are also those where the under-15 population is growing most rapidly; this places an even greater burden on systems and resources. Using only enrollment statistics and demographic projections, it appears that if universal primary education is to be achieved by 2015, primary schools in developing countries will have an estimated 110 million more primary-age children to absorb than they did in 2000/2005—an increase of roughly one fifth. Sub-Saharan Africa and South Asia, the two regions with the lowest current enrollment figures, will account for the lion's share of this increase.

Access to secondary education is poor throughout most of the developing world, particularly in those regions where primary-level enrollments are low. Transfer rates between primary and secondary education in many countries appear to be low, which suggests two possible scenarios. First, many countries may be still be focusing on the delivery of universal primary education, which may limit secondary school infrastructure and resources. The sharp decline in data available for secondary-level enrollments supports this possibility. Second, the drop in primary as compared to secondary enrollments may occur where survival rates in primary education are poor, and registration at the primary level cannot be equated with any significant educational attainment. This possibility indicates the importance of using data beyond enrollment figures, including attainment rates, (especially) completion rates, and quality indicators where these are available, to develop a picture of outputs and outcomes.[39]

Data

Table 1 in Appendix A uses UNESCO data to compare net enrollment at the primary and secondary levels. It also compares net enrollments by gender and calculates the extent of gender disparity in access to education where this occurs. Figures are for the most recent year available between 1998/99 and 2004/05. Data are available for 170 countries at the primary level, and 151 at the secondary level. Unlike other tables in this paper, unweighted country averages are used.[40]

Data for net enrollment rates are patchy. This lack of information is particularly marked at secondary level, across all regions and countries. One source suggests that the lack of data for India masks dropout rates of over 50 percent and the poorest rates of education among girls in South and East Asia (*Times of India*, 2004).

39. Indeed, relying solely on net enrollment ratios is far from the ideal way to determine transfer rates from primary to secondary education because, by definition, this indicator does not count students who are out of the age range of a specific level of education. The best way to study transfer rates would be to examine the experience of specific cohorts of students, but I do not have data to support such a study. One personal communication from UNESCO suggests that transition rates in at least some countries are considerably higher than is implied by a comparison of primary and secondary net enrollment rates.

40. It would be better to use weighted averages, but inconsistencies across countries in the designation of age groups for primary and secondary education, and the varied years for which the data are available, make weighting problematic.

This section discusses regional and national data. Variation within countries is likely to be significant, as the poor, those living in rural areas, and disadvantaged ethnic groups are likely to have much lower enrollment rates than the population as a whole. Data on these variations, to the extent they exist, are available only from national agencies. Although such national data will be useful to policymakers seeking to expand access to education, they are beyond the scope of this paper.

Primary Education

Globally, average net enrollment at the primary level is high. 86 percent of children[41] of primary school age are registered in school; within this population there is a 2-percentage-point gender disparity in favor of boys. Enrollment is strongest in the developed countries, where the average is 95 percent, with no gender disparity. Among developing world regions the strongest regions are Latin America/Caribbean, at 92 percent with a 1-percentage point disparity in favor of boys; East Asia/Pacific, at 90 percent with a 2-percentage-point disparity in favor of boys; and Eastern Europe/Central Asia at 90 percent, with a 1-percentage-point disparity in favor of boys.

The picture is considerably less promising in Middle East/North Africa (an average of 85 percent net enrollment in primary school), South Asia (79 percent), and particularly in Sub-Saharan Africa (70 percent). 12 of the 15 countries in the sample that have overall primary enrollment rates below 60 percent are in Sub-Saharan Africa, and average access to school falls as low as 36 percent in Burkina Faso and 38 percent in Niger. No recent figures (1998/99 or later) are available for the Democratic Republic of Congo, Sierra Leone, or Uganda, so these countries are not included in the analysis.

The relationship between poor overall access to primary education and high levels of gender disparity is strong. The same three regions with the lowest enrollment rates have the greatest disparities in access between boys and girls, rising to a high of 6 percentage points on average in Sub-Saharan Africa. Some of the largest gender disparities are in countries where overall access to primary education is near or below 60 percent. These include Chad, (where the gender gap among enrolled students favors boys by 23 percentage points), Benin (22 percentage points), and Guinea-Bissau (16 percentage points). UNESCO reports that in 11 countries girls are 20 percent less likely to start school than boys; 7 of these countries are located in Sub-Saharan Africa (UNESCO, 2003). As the data table in Appendix A shows, among the 11 countries with the largest gaps in access, all in favor of boys, only 4 have total average enrollment rates of at least 70 percent.[42]

41. This figure is based on the unweighted average of Table 1, Appendix A. The more detailed analysis described above shows that 85 percent are unenrolled.

42. These countries are: Togo (91 percent with a 16 percentage point gender disparity), Yemen (72 percent with a 25 percentage point gender disparity), Liberia (70 percent with an 18 percentage point gender disparity), and Iraq (91 percent with a 15 percentage point gender disparity).

The UNESCO data may well hide even larger gender disparities. Herz and Sperling (2004), citing other sources, offer an array of figures that document the extent to which girls in South Asia and Sub-Saharan Africa, especially in poor and rural areas, fail to complete even the earliest grades. Further, the figures show that even when girls do complete early grades, they often emerge with very minimal skills.

Within every region there is considerable variation, both in overall enrollments at the primary level, and in terms of equality of access to education.

For example, in the Middle East/North Africa region, total enrollment levels and equality of access are highly variable. Although some countries, including Algeria, Jordan, Palestine, and Tunisia, have high overall registration in primary education and little gender disparity, others have high total enrollment but limited access for girls. Iraq falls in the latter category, with 98 percent enrollment for boys versus 83 percent for girls. According to a UNESCO report on progress in Arab states, gender parity in education has only been achieved to date in Bahrain, Jordan, Lebanon, Palestine, and the United Arab Emirates (UNESCO-UIS, 2002).

In South Asia, where overall enrollment figures are highly variable, ranging from 92 percent in the Maldives and 88 percent in India, to 70 percent in Nepal and 59 percent in Pakistan, equality of access to primary education is extremely mixed. Enrollment of girls exceeds that of boys in Bangladesh by 4 percentage points, but Pakistan, Nepal, and India have disparities in favor of boys at the primary level of 18, 9, and 5 percentage points, respectively. As in Sub-Saharan Africa, figures for Pakistan and Nepal show that the relationship between relatively low enrollment and poor access to primary education for girls is strong. According to UNESCO estimates, 104 million children of primary school age are not enrolled in education, and 75 percent of these live in Sub-Saharan Africa and South Asia (UNESCO, 2003).

Secondary Education

64 percent of all children of secondary school age are enrolled in secondary education; this is 22 percentage points lower than at the primary level. (An additional 6 percent of secondary-school-age children are enrolled in primary school.) As with primary education, enrollments are highest in developed countries at 86 percent, where there is also a high transition rate from primary to secondary (a fall of 8 percentage points). In the developing world, levels of enrollment are generally extremely low. With the exception of Eastern Europe/Central Asia, where the average enrollment rate is 85 percent, more than one of every four children of secondary school age living in a developing country is not registered. In Sub-Saharan Africa (28 percent enrollment) and South Asia (48 percent), more than half of all secondary-school-age children are not enrolled.[43] A recent UNESCO report suggests that 19 of the 26 countries with less than 30 percent secondary-level enrollment are in Sub-Saharan Africa (UNESCO, 2003).

43. Because of missing data at the secondary level, the figure for South Asia does not include enrollment in India or Pakistan.

The contrast between enrollment at the primary and secondary levels is stark in many developing regions. In Sub-Saharan Africa, there is a gap of 42 percentage points between the two figures, and South Asia has a 31-percentage-point difference. The transfer from primary to secondary education is also far from smooth in East Asia/Pacific (a 34-percentage-point fall) and Latin America/Caribbean (23 percentage points), two regions with strong primary-level enrollments overall.

Many fewer countries provide data to UNESCO on enrollments at the secondary level than at the primary level; for example, Bangladesh and the Maldives are the only countries in South Asia to do so.

Within Sub-Saharan Africa, where overall registration is lowest, there are no data available for several countries, even for some with high enrollments at the primary level, including Gabon and Rwanda. In countries where data are available, the transfer to secondary education appears to be weak (although the cautions cited earlier about using enrollment rates as indicators of transfer are relevant here), even where access to primary education is relatively high. For example, an 82 percent primary registration rate in Tanzania contrasts with a 5-percent enrollment figure in secondary school, a decline of 77 percentage points. In Senegal, the difference is 69 percentage points. The results are similar in many countries, including Madagascar, Lesotho, Togo, Congo, Liberia, and Mauritania.

Gender disparity is, at the secondary level, much less marked than for the primary level, except where low overall enrollment masks gender disparity. UNESCO notes that considerable progress in gender equality was made in the 1990s; for example, Algeria, Malawi, Mauritania, Nepal, Niger, Pakistan, Rwanda, Sierra Leone, and Tunisia all gained over 0.2 points on the gender parity index[44] (UNESCO, 2003). However, total numbers of enrolled students are much smaller. Data show that on average in Sub-Saharan Africa, only about one in every four girls is enrolled in secondary education. Among all countries in the world, gender disparity in favor of boys is highest in Yemen, at 26 percentage points. However, at the secondary level there are also marked examples where more girls are enrolled in school than boys, a list led by Guyana (with a difference of 34 percentage points).

There is considerable variation in enrollment rates within every developing world region. In Latin America/Caribbean, eight countries—Anguilla, Argentina, Barbados, Chile, Cuba, Dominica, Grenada, and Saint Kitts and Nevis—have secondary enrollments above 80 percent. By contrast, 50 percent or more of all secondary-school-age children in the Dominican Republic, Ecuador, El Salvador, Guatemala, and Nicaragua are not registered in secondary school, although primary-level enrollment is above 80 percent in all five of these countries. This region also includes six of the eleven highest gender disparities in favor of girls at the secondary level, suggesting that completion of basic education and successful transition to secondary school is elusive to many boys.

East Asia/Pacific, which also has generally high primary enrollment levels, presents a similar picture. Niue is the only country with average secondary-

44. The gender parity index is defined as the ratio of female to male values of a given indicator.

level enrollment over 80 percent, and fewer than 50 percent of secondary-school-age children in Cambodia, Laos, Myanmar, Papua New Guinea, and Vanuatu are registered in secondary school, although primary enrollments are above 80 percent in all except Papua New Guinea (where primary enrollment is 74 percent). Cambodia, Laos, and Papua New Guinea also have the highest gender disparity of access in the region in favor of boys, at 11, 6, and 6 percentage points respectively. These are not the highest rates of gender disparity, however, as Mongolia, the Philippines, and Tonga report gender disparities in favor of girls of 11, 11, and 10 percentage points, respectively.

EDUCATIONAL ATTAINMENT—CURRENT POSITION

Overview

The Barro-Lee and Cohen-Soto datasets show that attainment[45] in primary education is widespread, but some regions and countries lag behind. Leaders and laggards are the same as for net enrollment data. In most regions, data extrapolated from Barro-Lee and Cohen-Soto suggest that developing regions are making some progress toward universal primary education. By contrast, but also in common with net enrollment, attainment rates at the secondary level are low throughout the developing world, particularly in regions that lag for other indicators.

Gender disparity in attainment is strong at both the primary and secondary levels, and for the 15–24 year-old cohort as well as the 25+ population. Strong attainment gaps in favor of boys are most common in developing regions where disparity is strongest in enrollments, particularly East Asia/Pacific and South Asia, although small group sample sizes may affect regional averages in some cases (notably Eastern Europe/Central Asia).

Data

Both the Barro-Lee and Cohen-Soto data on primary- and secondary-level attainment for the 25+ population were considered in this analysis. The samples are not identical; Barro and Lee include 104 countries and Cohen and Soto, 95. In addition, a comparison was also made of extrapolated data for the 15–24 year-old cohort on primary and secondary attainment, using the Barro-Lee and Cohen-Soto datasets for the 15+ and 25+ populations.[46] These data are not analyzed except at the regional level, owing to considerable discrepancies and inconsistencies. Even at the regional level, great caution must be exercised in interpreting the results because of data problems discussed above.

Figure 5 uses data from the Barro-Lee dataset to compare primary attainment between regions, for both the 25+ population and the 15–24 year-old cohort. Figure 6 makes similar comparisons for secondary attainment.

45. Attainment is defined as having participated in some education at a given level. It does not imply completion.

46. Full country-level comparison tables for both datasets, for primary and secondary attainment in both the 25+ population and the 15–24 year-old cohort, are available online at http://www.amacad.org/projects/ubase.aspx, or by request.

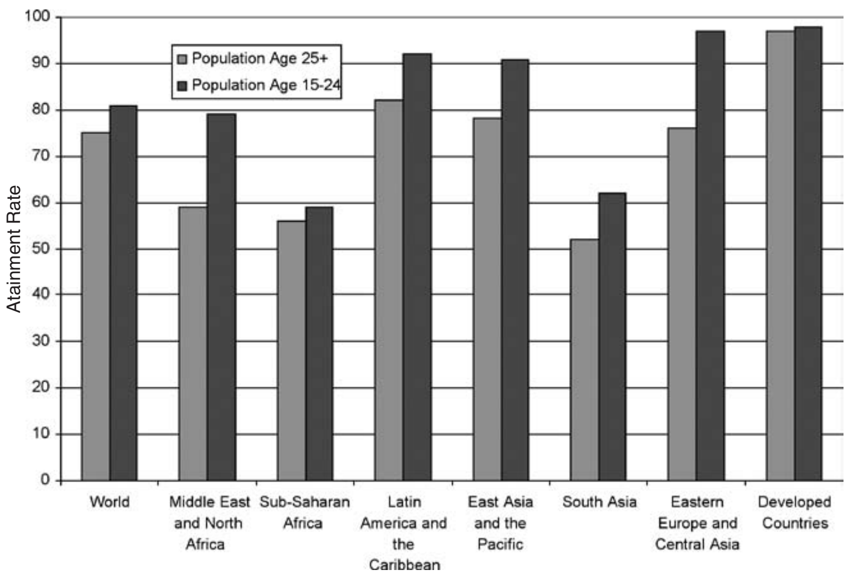
Figure 7 considers regional patterns of gender disparity in primary and secondary attainment for the 25+ population, using information from the Barro-Lee dataset. An additional table, available online, compares extrapolated data for the 15–24 year-old cohort on gender disparity at the primary and secondary levels, using the Barro-Lee datasets for the 15+ and 25+ populations.

Primary Education

At the global level, the datasets broadly agree on attainment levels in primary education among the 25+ population, with roughly three in four people worldwide having spent some time in school at the basic level. Extrapolation for the 15–24 year-old cohort further suggests that this indicator of educational access is rising at the global level, although the datasets do not agree on how sharp this increase is.[47]

As shown in Figure 5, attainment at the primary level is strongest in developed countries, reaching near-universal participation in some basic education among the 15–24 year-old population. In the developing world, attainment rates are highly variable, and follow a similar pattern to net enrollment (see Appendix A, Table 1A); Latin America, Caribbean, East Asia/Pacific, and Eastern Europe/Central Asia all have relatively high levels of attainment, and the Middle East/North Africa, South Asia, and Sub-Saharan Africa regions lag. Regionally, extrapolation for the 15–24 year-old cohort shows considerable improvements over the total population in attainment for all developing regions.[48]

Figure 5: Primary Attainment, Year 2000 (Barro and Lee Data)



Source: Barro and Lee (2000), with data extrapolated for population age 15–24.

47. Barro-Lee data suggest 81 percent have some attainment; Cohen-Soto data suggest 95 percent.

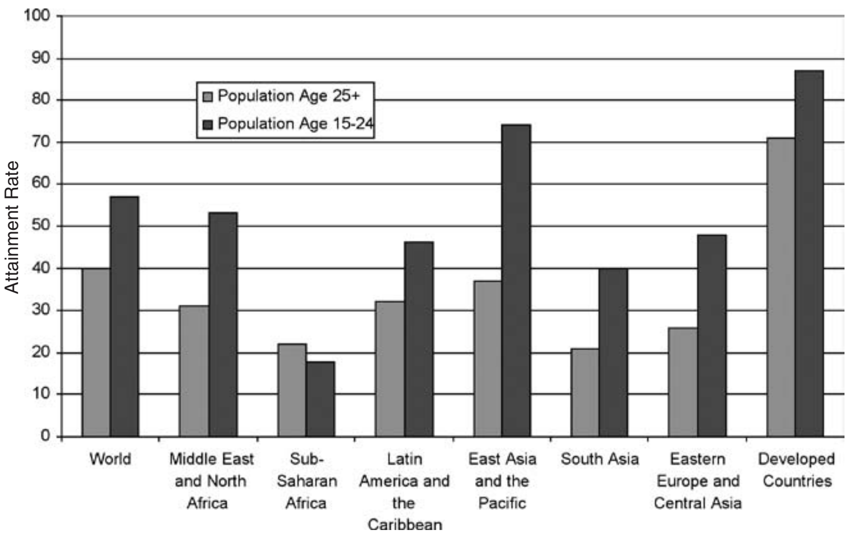
48. An exception is the Barro-Lee data for Sub-Saharan Africa, which suggest little change.

The Barro-Lee dataset shows widespread gender disparity in attainment rates in primary education in the 25+ population (see Figure 7), but also in the extrapolated data for the 15–24 year-old cohort. This large disparity is in sharp contrast to the narrow gap in favor of boys observed globally for net enrollments shown in Appendix A, Table 1. Disparity is negligible in the developed countries, but Figure 7 shows particularly weak levels of female participation in some basic education in South Asia (38 percent), Middle East/North Africa (47 percent), and Sub-Saharan Africa (48 percent). There is also a marked disparity in East Asia/Pacific, where male primary attainment is 21 percentage points higher than that of females, although both male and female figures are much higher than in these other regions. Data weaknesses make even regional analysis for the 15–24 year-old cohort inadvisable.

Secondary Education

As with net enrollment data, secondary-level attainment shows a sharp decline globally compared with primary education, according to both datasets. Figure 6 shows that while three in four of the 25+ population have participated in some basic education, fewer than one in two has participated in secondary education. Although data suggest some improvement among the 15–24 year-old group, global figures stand at just over 50 percent of the cohort.

Figure 6: Secondary Attainment, Year 2000 (Barro and Lee Data)

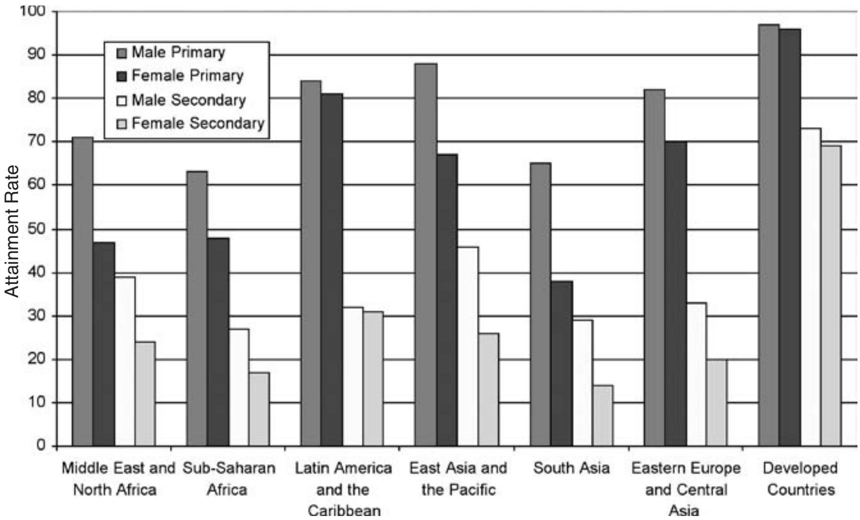


Source: Barro and Lee (2000), with data extrapolated for population age 15–24.

In every region of the developing world, secondary attainment is extremely low for the 25+ population, particularly in Sub-Saharan Africa and South Asia. Barro-Lee data also find that only 71 percent of all adults over age 25 have participated in some secondary education. Extrapolated data suggest this has improved dramatically in some regions, particularly East Asia/Pacific, but that the situation is stagnant, or worsening, in Sub-Saharan Africa.

The Barro-Lee dataset shows strong gender disparity for the 25+ and the 15–24 year-old populations in terms of secondary-level attainment, similar to the disparity it shows for primary education, as shown in Figure 7. Although extrapolated data show that participation in secondary schooling rises by almost 20 percentage points for the younger cohort, the gender gap in favor of boys remains constant at 20 percentage points.

Figure 7: Gender Disparity in Primary and Secondary Attainment (Population Age 25+, Year 2000)



Source: Barro and Lee (2000).

EDUCATIONAL COMPLETION—CURRENT POSITION

Overview

Patterns of regional leaders and laggards in completion[49] at the primary and secondary levels are broadly similar to patterns of both net enrollment and attainment. Further, data for primary-level completion suggest significant recent improvement, with the exceptions of South Asia and Sub-Saharan Africa. Improvements in secondary-level completion rates are hard to assess, given that many in the 15–24 year-old cohort are not yet old enough to have graduated.

Patterns of gender disparity in completion rates broadly mirror those observed for attainment and enrollment. Disparity tends to be strongest in favor of boys in East Asia/Pacific and South Asia.

Data

As with the attainment data, the Barro-Lee and Cohen-Soto datasets on primary- and secondary-level completion for the 25+ population were com-

49. Completion is defined as having finished a given level of education.

pared, regionally, and by country,[50] and data were extrapolated on primary completion for the 15–24 year-old cohort, using both datasets. These data are not analyzed except at the regional level, owing to considerable discrepancies and inconsistencies.[51]

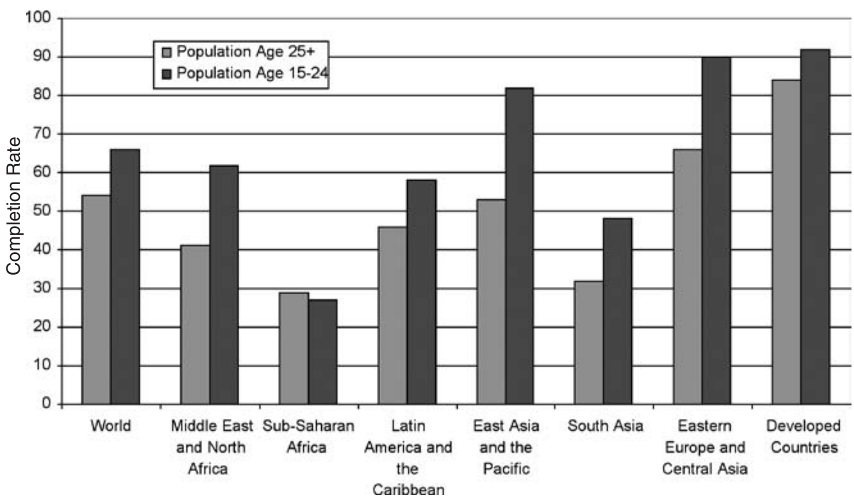
Figure 8 uses data from the Barro-Lee dataset to compare primary attainment between regions, for both the 25+ population and the 15–24 year-old cohort. Figure 9 shows secondary completion for the 25+ population.

Figure 10 considers regional patterns of gender disparity in primary and secondary completion for the 25+ population, using information from the Barro-Lee dataset. An additional table, available online, compares extrapolated data for the 15–24 year-old cohort on gender disparity at the primary level, using the Barro-Lee datasets for the 15+ and 25+ populations.[52]

Primary Education

At the global level, Barro-Lee data show that roughly one person in two over age 25 has completed primary education (see Figure 8); Cohen-Soto data show higher overall figures, at 66 percent. When data are extrapolated for the 15–24 year-old cohort, both datasets suggest rises in primary completion, Barro-Lee to 66 percent, and Cohen-Soto to 82 percent.

Figure 8: Primary Completion, Year 2000 (Population Age 25+)



Source: Barro and Lee (2000), with data extrapolated for population age 15–24.

50. As is the case with attainment data, the samples are not identical: Barro-Lee data include 104 countries and Cohen-Soto, 95.

51. Full country-level comparison tables for both datasets, for primary completion in both the 25+ population and the 15–24 year-old cohort (primary only), are available online, at http://www.amacad.org/projects/ubase.aspx.

52. The country-level data on gender disparity in both attainment and completion are available online, at http://www.amacad.org/projects/ubase.apsx.

Completion rates are, by definition, lower than attainment rates.[53] However, similar patterns are discernible for primary-level completion in the 25+ population as for enrollment and attainment. Broadly, Eastern Europe/Central Asia, East Asia/Pacific, and Latin America/Caribbean lead the developing world, while South Asia, Sub-Saharan Africa, and to a lesser extent, the Middle East/North Africa lag.

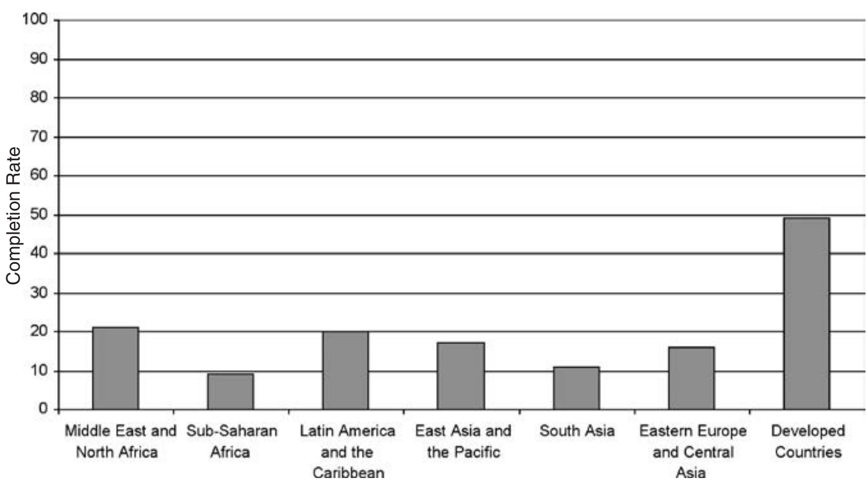
Extrapolation for the 15–24 year-old cohort produces some extreme differences between the datasets at regional level, but progress in completion rates is observable for most cases. In particular, both datasets suggest improvement of at least 20 percentage points in Middle East/North Africa,[54] and both figures for Eastern Europe/Central Asia indicate that primary-level completion has reached near-universal levels among the younger group.

As with attainment, Barro-Lee data show strong gender disparity in completion levels for primary education—13 percentage points in the 25+ population. Extrapolated data for the 15–24 year-old cohort show no improvement at the global level. Once again, although the disparity is negligible in developed countries and Latin America/Caribbean, gaps in favor of boys are particularly strong in South and East Asia, as well as the Middle East/North Africa.

Secondary Education

Global completion rates at the secondary level for the 25+ population are extremely low, at 24 (Barro-Lee) or 28 (Cohen-Soto) percent . In developed

Figure 9: Secondary Completion, Year 2000 (Population Age 25+)



Source: Barro and Lee (2000).

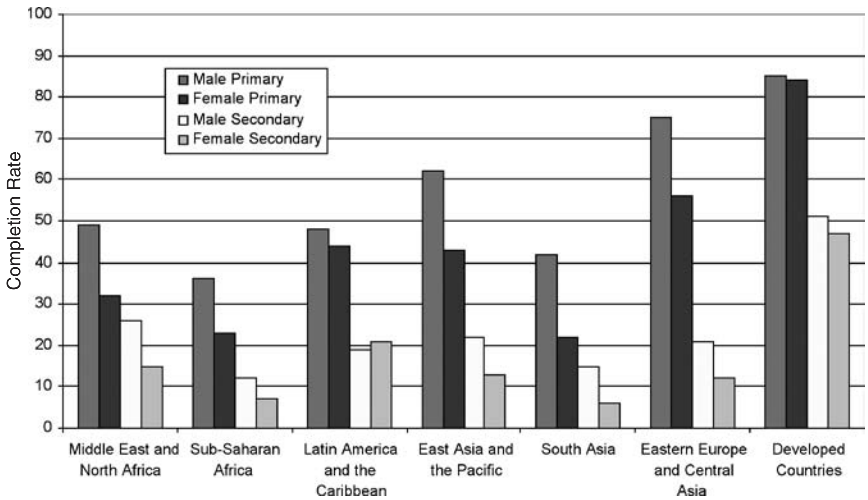
53. A student is considered to have "attained" a level of education by virtue of having begun to study at that level, whereas "completion" requires finishing the level. Anyone who has completed a level education has also attained it, but not vice versa.

54. Extrapolated completion rates for Middle East/North Africa are 62 (Barro-Lee) and 77 percent (Cohen-Soto).

countries, completion of secondary education is placed at 49 (Barro-Lee) or 66 (Cohen-Soto) percent of the total population. As with other quantitative indicators, Sub-Saharan Africa and South Asia lag the rest of the world, as shown in Figure 9.

Globally, gender disparity in completion is less marked for secondary than primary education among the 25+ population, and it mirrors the weak gaps in favor of boys for secondary-level attainment, as shown in Figure 10.

Figure 10: Gender Disparity in Primary and Secondary Completion (Population Age 25+, Year 2000)



Source: Barro and Lee (2000).

TRENDS IN ATTAINMENT AND COMPLETION

Trends in attainment and completion rates tend to mirror trends in enrollment. Regional leaders and laggards remain much the same.[55]

Data

The analysis considered data from the Barro-Lee and Cohen-Soto datasets relating to trends in primary and secondary attainment and completion. Trend data on primary and secondary attainment between 1990 and 2000 for the 15–24 year-old cohort were calculated. A selection of these calculations are used in the figures below, and full tables are available online. Additional analyses considered primary and secondary attainment and completion rates for each decade from 1960 and 1990; these tables are available online.

Figure 11 presents data for low-income countries, showing changes in primary attainment rates, for the 15–24 year-old cohort over the decade 1990–2000.

55. Goujon and Lutz (2004) present a new methodology for assessing a population's educational achievements over time. They account for demographic change and the future effect of educational achievement on fertility rates.

Figure 12 uses the percentage-point increase in primary- and secondary-level attainment from 1990 to 2000 to project attainment in 2015 for the 25+ population.

Tests run for both datasets, and for both attainment and completion rates, suggest reasonably high positive correlations with the share of the population that lives in urban areas.

Trends in Attainment Levels, 1990–2000

Primary-level attainment rates in developed countries, East Asia/Pacific, and Latin America/Caribbean were already very high in 1990, and most countries showed no change or only a very small improvement throughout the subsequent decade. Figure 11 shows percentage-point increase or decrease in primary attainment over the period for developing countries. In the Middle East/North Africa region, improvements at the primary level were slightly larger and several countries had improvements of over 10 percentage points. The largest improvements in primary attainment overall are seen in South Asia, although there is disagreement between datasets over the scale of progress. The Eastern Europe/Central Asia dataset is small, but overall there appears to be a slight decrease in primary attainment.

In Sub-Saharan Africa, progress is patchy; some countries show significant increases or decreases, and others show little or no change. According to the Barro-Lee data, 16 of 26 countries in Sub-Saharan Africa show increases or decreases of 5 percent or less in primary attainment rates between 1990 and 2000. Among the remaining countries, a few show large improvements but seven countries show decreases in attainment, with the greatest decrease in South Africa at 21 percentage points.

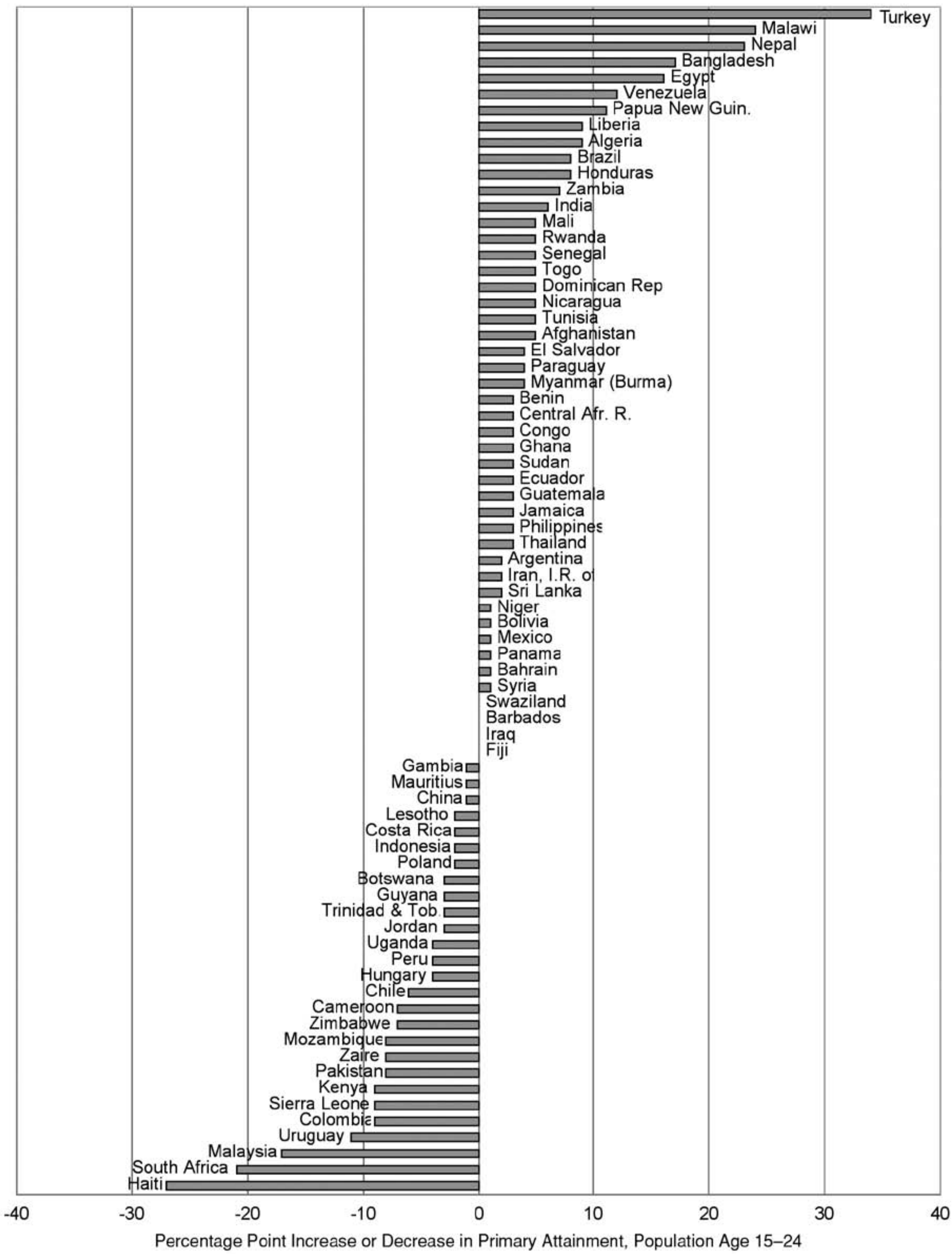
At the secondary level, more countries in the developed group, East Asia/Pacific region, and Latin America/Caribbean region show some improvement, but there are also some significant decreases in attainment, in Kuwait (18 percentage points, Barro-Lee) and Hong Kong (27 percentage points, Barro-Lee). There are large discrepancies between datasets for a number of countries in these regions, and although there are large (and likely improbable) decreases in attainment in West Germany and Switzerland according to Cohen-Soto, and in Singapore according to Barro-Lee, in each of these countries the other dataset suggests little or no change, precluding reliable conclusions.

The Eastern Europe/Central Asia dataset shows moderate improvements at the secondary level. In both South Asia and Sub-Saharan Africa, improvements in secondary attainment are weaker than in primary attainment.

Trends in Attainment Levels, 1960–2000

Attainment at the primary level has in general improved steadily since 1960. The two datasets are generally in agreement, increasing confidence in the data. Most developed countries, with high levels of attainment, show low levels of progress. In Eastern Europe/Central Asia, Turkey stands out as making larger improvements than other countries in the region. Improvements

Figure 11: Changes in Primary Attainment, 1990–2000



Source: Data extrapolated from Barro and Lee (2000).

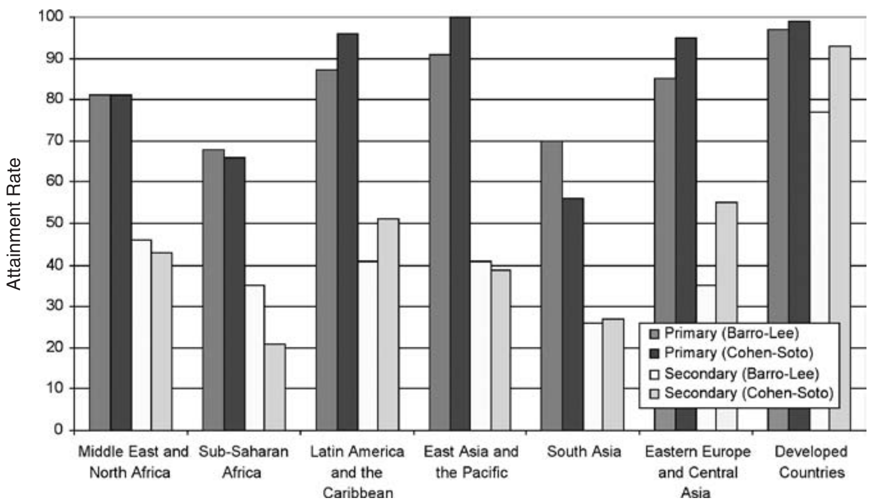
appear to be greatest in the Middle East/North Africa and East Asia/Pacific. Improvement is mixed in Sub-Saharan Africa.[56]

The trends in secondary attainment over the forty-year period show a different pattern, with the highest overall gains in developed countries and somewhat lower improvements in other regions. The least improvement occurs in Sub-Saharan Africa. Among the developed countries, Finland and Korea achieve total improvements of over 60 percentage points in both datasets during the period measured. However, the data for Australia, Canada, Denmark, New Zealand, and West Germany all show very large (and likely improbable) discrepancies between datasets.

In developing countries, gains are observable in East Asia/Pacific, Middle East/North Africa, and Latin America/Caribbean, although a few countries show very low levels of progress: Myanmar shows a total improvement of 7 percentage points (Barro-Lee) and 16 percentage points (Cohen-Soto) over the period measured, and Haiti and Guatemala show total improvement of approximately 10 percentage points in both datasets.

Gains in South Asia are also substantially lower than in developed countries, ranging from 24 percentage points (Barro-Lee) in Sri Lanka, to a 2-percentage-point decline in Afghanistan. The weakest improvements are in Sub-Saharan Africa, where 14 countries show total gains of less than 10 percentage points in both datasets. A few countries in this region do show large improvements, with the highest figures in Zimbabwe (total percentage-point improvement of 32 (Barro-Lee) and 30 (Cohen-Soto) over the period measured).

Figure 12: Attainment in 2015 at Current Rate of Change (for Population Age 25+)



Source: Barro and Lee (2000) and Cohen and Soto (2001).

56. For example, very little improvement is seen in Mali and Niger—both countries improve by 11 percentage points (Barro-Lee) and 9 percentage points (Cohen-Soto) over the period measured. At the other end of the range, substantial percentage point improvements have taken place in Kenya (44 points (Barro-Lee) and 55 points (Cohen-Soto)) and Zambia (49 (Barro-Lee) and 41 (Cohen-Soto)) over the period measured.

Figure 12 shows projected primary and secondary attainment rates for the 25+ population in 2015, based on progress by country during the 1990s. This information shows the slow rate at which improvements in this key quantitative indicator of universal basic and secondary education affect education stock in the total population.

Trends in Completion Levels, 1990–2000

As with attainment levels, many countries saw increased primary- and secondary-level completion during the 1990s. There were few increases in completion rates in the developed world, presumably due to high levels of completion before 1990. For some developing countries, increases were extremely high, which at face value suggests a decade of significant progress; however, discrepancies between datasets make firm conclusions very hard to draw.[57]

Comparisons suggest that information generated from the datasets does not agree consistently on which countries and regions had worsening completion rates over the 1990 to 2000 period.[58] The most positive and definite point that can be made about the two tables is that there are many fewer countries where either or both sets of data indicate declining levels of primary completion for the 15–24 year-old cohort than countries where one or both indicate progress in completion rates.

Trends in Completion Levels, 1960–2000

As with similar attainment data, average completion rates for all countries at the primary level for each decade from 1960 to 1990 among the 25+ population show reasonably steady progress over the period. Both Barro-Lee and Cohen-Soto suggest a slight stagnation between 1980 and 1990. Data for individual countries show much more significant advances and stagnations. Thailand shows relatively slow progress (Cohen-Soto) and negative development (Barro-Lee) in the 1960s and 1970s, but a large leap in the 1980s—31 (Barro-Lee) and 60 (Cohen-Soto) percentage points—with further increases in the 1990s. These data, along with others in the table, not only show significant discrepancies between datasets, but also suggest decadal changes that are too extreme to be plausible, given that the information is for the 25+ population, not individual cohorts.

On a worldwide basis, trends in secondary-level completion from 1960 to 1990 are similar to those trends seen in primary education. The average steady upward trend for all countries is similar to progress in primary and secondary attainment.

Although discrepancies in the data and between datasets make it hard to draw firm conclusions, the data suggest that progress toward higher second-

57. For example, Barro-Lee records a 5-percentage-point improvement in primary completion rates over the decade in Bangladesh, compared with a 46-percentage-point improvement according to Cohen-Soto. Similarly, for Venezuela, Barro-Lee suggests a 52-percentage-point improvement in primary level completion, while Cohen-Soto finds just 19.

58. For example, while Barro-Lee suggests a decrease in primary completion rates of 44 percentage points for Singapore, Cohen-Soto finds an improvement of 7 percentage points.

ary completion rates may be particularly slow in some parts of Sub-Saharan Africa.[59] Tentative though this evidence is, it fits with the picture of Sub-Saharan Africa lagging the rest of the developing world—on every indicator from enrollments to trends in completion rates.

INDICATORS OF EDUCATIONAL QUALITY

Overview

Although TIMSS, PIRLS, and PISA are all limited by the small number of countries included in the studies and their strong bias toward the developed world, they do offer some useful evidence about the quality of educational outputs for three core skills at the primary and secondary level.

All three indicators suggest that the quality of educational outputs is generally higher in developed countries. Recent studies by both Barro and Lee and Hanushek and Kimko find a positive relationship between test scores and growth rates of real per capita GDP (cited in Barro and Lee, 2000). PISA data suggest that 43 percent of variations among countries' mean scores for reading, numeracy, and scientific understanding at the secondary level can be predicted on the basis of their GDP per capita (OECD/UNESCO-UIS, 2003). This correlation is further supported by the TIMSS and PIRLS data in Tables 5 and 6.

With the exception of Eastern Europe/Central Asia, relatively low levels of literacy, numeracy, and scientific understanding are demonstrated in all developing countries included in the dataset. This gap is particularly striking in the PIRLS and PISA data available for Latin America/Caribbean countries, where mean performances in tests are poor, compared with enrollment and attainment rates.

Data

Table 3 sets out mean scores on standardized tests in science and math for Grade 8 equivalent students in 38 countries. 45 percent of these countries are in the developed world, 32 percent are from Eastern Europe/Central Asia, and 10 percent each are from East Asia/Pacific and Middle East/North Africa. No country in South Asia is included, and from Latin America/Caribbean and Sub-Saharan Africa, only Chile and South Africa respectively have participated. Mean scores are ranked from highest to lowest, and for math, gender disparity in achievement is also recorded.

Table 4 sets out mean scores on standardized tests in reading for Grade 4 equivalent students in 35 countries. 49 percent of these countries are in the developed world, 34 percent are from Eastern Europe/Central Asia, and 8 percent each are from Latin America/Caribbean and Middle East/North Africa. No country in Sub-Saharan Africa, South Asia, or East Asia/Pacific (other than those in the developed world group) is included. Mean scores are

59. For example, Cohen-Soto data suggest improvements in secondary level attainment rates for Kenya at between 2 and 6 percentage points each decade, but improvements in completion rates between 0 and 1 percentage point.

Table 3: TIMSS Math and Science Test Scores (with Gender Differences for Math)

Math			Science	
Country	Score	M – F	Country	Score
Singapore	604	2	Taiwan	569
Korea, Rep of	587	5	Singapore	568
Taiwan	585	NA	Hungary	552
Hong Kong	582	-2	Japan	550
Japan	579	8	Korea, Rep of	549
Belgium (Flemish)	558	-4	Netherlands	545
Netherlands	540	5	Australia	540
Slovakia	534	5	Czech Republic	539
Hungary	532	6	England	538
Canada	531	3	Finland	535
Slovenia	530	1	Slovakia	535
Russian Federation	526	1	Belgium (Flemish)	535
Australia	525	2	Slovenia	533
Finland	520	3	Canada	533
Czech Republic	520	17	Hong Kong	530
Malaysia	519	-5	Russian Federation	529
Bulgaria	511	0	Bulgaria	518
Latvia	505	5	United States	515
United States	502	7	New Zealand	510
England	496	19	Latvia	503
New Zealand	491	-7	Italy	493
Lithuania	482	3	Malaysia	492
Italy	479	9	Lithuania	488
Cyprus	476	-4	Thailand	482
Romania	472	-5	Romania	472
Moldova	469	3	Israel	468
Thailand	467	-4	Cyprus	460
Israel	466	16	Moldova	459
Tunisia	448	25	Macedonia	458
Macedonia	447	0	Jordan	450
Turkey	429	2	Iran	448
Jordan	428	-7	Indonesia	435
Iran	422	24	Turkey	433
Indonesia	403	5	Tunisia	430
Chile	392	9	Chile	420
Philippines	345	-15	Philippines	345
Morocco	337	17	Morocco	323
South Africa	275	16	South Africa	243

Note: Scores are for students in Grade 8, for most countries.
Source: Data are from TIMSS 1999. http://timss.bc.edu.

ranked from highest to lowest, and gender disparity in achievement is also recorded.

These data are compared with results from PISA 2000, a study that tested between 4,500 and 10,000 15 year-old students in 43 countries (OECD/UNESCO-UIS, 2003). PISA includes assessment in three core forms of literacy—reading, numeracy, and scientific understanding—as well as background questionnaires on issues including family background and attitudes toward study.

Of the countries included in this study, 28 are members of the OECD, and of those that are not, three—Hong Kong, Israel, and Liechtenstein—are in the developed world group. 21 percent of the PISA sample is from Eastern Europe/Central Asia, 12 percent from Latin America/Caribbean, and 5 percent from East Asia/Pacific. No country in South Asia, Middle East/North Africa, or Sub-Saharan Africa is included.

Of the world's 10 most populous countries, TIMSS includes four (the United States, Indonesia, Russia, and Japan), PIRLS includes two (the United States and Russia), and PISA includes five (the United States, Indonesia, Brazil, Russia, and Japan). China will be included in future PISA studies. This gives a sense of the limited scope of these test-based indicators of educational quality in capturing a global picture of the outputs of education, particularly with regards to the developing world and its poorest regions in South Asia and Sub-Saharan Africa.

TIMSS Results

Mean math scores (Table 3) show a striking division between quality of educational outputs at the primary level in developed and developing countries. Of the top 10 countries for math, 7 are from the developed world group, and developing countries form the whole bottom 10. There is a difference of 170 points (from a total possible score of 800) between average test scores for the top and bottom 10 countries. These results are significant, both statistically and practically. Scores from the 95th percentile of the lowest-scoring nation, South Africa, roughly correspond with scores from the 5th percentile of the highest-scoring nation, Singapore (these scores are 485 and 464, respectively) (IEA, 2000). The results are similar for science, although the gap between average scores for the top and bottom 10 countries is slightly narrower, at 150 points. Four countries have average test scores of below 400 for math (Chile, Morocco, the Philippines, and South Africa), and three have sub-400 averages for science (Morocco, the Philippines, and South Africa).

In both subjects, developed countries in East Asia score particularly well; they represent the entire top 5 for math, and 4 of the top 5 for science. This dominance is also observed at the secondary level in the PISA assessments, where students in Hong Kong, Japan, and Korea display the highest overall performances in both math and science (OECD/UNESCO-UIS, 2003). Malaysia also ranks relatively well for math, at 16th, 86 points behind Singapore's mean score and ahead of several developed countries including England, New Zealand, and the United States. Other scores for East Asia/Pacific countries are much lower; in particular, Indonesia is in the bottom 5 countries for math and the bottom 10 for science.

Performance for countries in the Eastern Europe/Central Asia region is extremely mixed. Although the Czech Republic, Hungary, Slovakia, and Slovenia all rank in the top 15 countries in math and science with scores in the mid- and low-500s, Macedonia, Moldova, Romania, and Turkey are all in the bottom 15 for both subjects with scores in the mid- and low-400s. In math, there is a difference of 105 points between Slovakia's mean score and Turkey's, and in science the gap is 119 between Hungary and Turkey.

The few countries included in the TIMSS program from other developing world regions score relatively poorly in both subjects, always within the bottom 10 countries. The bottom 4 countries are identical across science and math rankings. Further, there is a wide spread of scores within the bottom 5 countries. In math, for example, there is a difference of 128 points between Indonesia and South Africa's mean scores, and the gap is even wider for science.

Gender disparity in math scores is markedly in favor of boys in most countries, reaching a high of 25 percentage points in Tunisia, and is extremely distinct in some developed countries as well, including England at 19 percentage points and Israel at 16 percentage points. The pattern of better achievement in math among males generally continues at the secondary level.[60] In a few countries girls score better on average than boys, but the difference is less striking, except in the Philippines, where the gap is 15 percentage points in favor of girls (OECD/UNESCO-UIS, 2003).

PIRLS Results

Table 4 shows a similar (although slightly less marked than for math and science) contrast in quality of educational outputs at the primary level for reading between developed and developing countries. Six of the top ten countries are in the developed world group, and 9 of the bottom 10 are developing countries. The gap between the mean test score for Sweden, the top-ranked country, and Belize at the bottom of the list, is 234 points (where the total possible score is 800 points), and three countries (Belize, Kuwait, and Morocco) have an average reading score below 400.

Mean scores in Eastern Europe/Central Asia countries are, as with TIMSS scores for math and science, extremely mixed, ranging from 551 in Bulgaria (the 3rd ranked country), to 442 in Macedonia (29th), a gap of 109 points. Some countries that score relatively well in math and science show similar results for reading, including Bulgaria, the Czech Republic, Hungary, Latvia, Lithuania, and Russia, while others, notably Macedonia and Turkey, rank consistently in the bottom 10 for all three subjects, with average scores in the mid- and low-400s.

60. For example, the 7-percentage-point disparity in favor of boys observed in TIMSS scores for the United States is repeated at age 15 in the PISA math assessment (OECD/UNESCO-UIS, 2003).

Table 4: PIRLS Reading Test Scores and Gender Differences

Country	Overall Score	M – F
Sweden	561	-22
Netherlands	554	-15
England	553	-22
Bulgaria	551	-24
Latvia	545	-22
Canada	544	-17
Lithuania	543	-17
Hungary	543	-14
United States	542	-18
Italy	541	-8
Germany	539	-13
Czech Republic	537	-12
New Zealand	529	-27
Scotland	528	-17
Singapore	528	-24
Russian Federation	528	-12
Hong Kong	528	-19
France	525	-11
Greece	524	-21
Slovakia	518	-16
Iceland	512	-19
Romania	512	-14
Israel	509	-22
Slovenia	502	-22
Norway	499	-21
Cyprus	494	-24
Moldova	492	-25
Turkey	449	-19
Macedonia	442	-21
Colombia	422	-12
Argentina	420	-18
Iran	414	-27
Kuwait	396	-48
Morocco	350	-20
Belize	327	-27

Note: Scores are for students in Grade 4, for most countries.
Source: Data are from PIRLS 2001. http://timss.bc.edu.

As with TIMSS scores, countries taking part in PIRLS from other developing regions all score relatively poorly for reading skills, ranking in the bottom 6 places in the table. Scores for the 2 countries included in both TIMSS and PIRLS are also similarly placed relative to others, in the low-400s for all three subjects. Poor scores in reading skills for all three Latin America/Caribbean countries included are particularly notable, because this is a developing region where access to (see Appendix A, Table 1), and attainment of (see Figure 5) primary education are high. However, completion rates (see Figure 8) are lower than enrollment and attainment rates for this region, which, combined with the small amount of evidence provided by PIRLS data, suggests that the quality of education in some countries in this region may be limited.

Gender disparity in mean reading scores at the primary level is universally, and in many cases very strongly, in favor of female students. There is no relationship between position in the ranking and the extent of girls' ascendancy in this subject. As with math and science, a pattern of disparity continues at the secondary level; PISA data also show significantly better performance by females across its sample for reading, rising to a gap of 58 percent in Albania (OECD/UNESCO-UIS, 2003). In many cases where data are available for both PIRLS and PISA, gender disparity in reading attainment tends to widen between primary and secondary levels.

Conclusion

The picture of progress toward UBASE offered by these data remains blurred and partial, and forecasting achievement of the Millennium Development Goal is all but impossible. Inconsistencies in basic data generate difficulties in understanding education systems; these difficulties are exacerbated by the limited range of available indicators, particularly of processes and outcomes.

The Barro-Lee and Cohen-Soto datasets, via their measurement of the 25+ and 15+ populations, give an indication of overall progress in education, but an assessment of the stocks of educational attainment and completion within the adult population does not in itself contribute to a clearer understanding of universal access to, and completion of, primary and secondary education. The Barro-Lee and Cohen-Soto data show very high intersource discrepancies, as well as internal inconsistencies that emerge when data are manipulated to produce figures for a particular cohort. Using these data to identify progress toward universal attainment and completion at the primary and secondary levels, and to assess the extent of gender disparity for these measures, is hazardous. Although firm conclusions are hard to draw, observable general regional patterns confirm that progress toward UBASE remains weakest in South Asia and Sub-Saharan Africa.

Enrollment data, too, have their weaknesses. First, UNESCO data rely heavily on country estimates, which can lead to poor-quality information where schools are funded on the basis of total enrollments. Further, information is not always available for the most recent school year, may be contaminated by students repeating grades, and includes those who register but never spend time in school. More important, enrollment does not measure any outcome of an educational system, so it needs to be considered alongside other data in order to provide even a rudimentary picture of progress or the current situation.

A combination of enrollment and completion data on a cohort-by-cohort basis could provide an effective measure of progress in getting children into and through school, but would still lack important information on the quality of education. Indicators like TIMSS, PIRLS, and PISA currently provide estimates of quality, but only for a limited group of countries, and with very few reference points for the developing world. The information that is available for the developing world suggests that the quality of educational outputs in these countries, including those that have high levels of net enrollment, is generally poor by comparison with the developed world. Increasing the scope of these indicators could be extremely useful in sharpening the picture of disparity in educational quality.

Higher quality input measures and more widespread output statistics are necessary, but not sufficient, for making well-informed policy decisions to improve educational quality. One missing and necessary link is data on educational processes. Effective policy depends upon not only a sound foundation of knowledge but also political will and resources. Data linking education inputs to economic, health, and other developmental outcomes is necessary for the continued mobilization of scarce resources for education.

Implications for the Future

FINDINGS

Primary and secondary education—in both developed and developing countries—have been the object of substantial, if insufficient, data collection efforts. These data are examined in this paper using a taxonomy of inputs, processes, outputs, and outcomes. This taxonomy provides a more detailed view than the usual educational quality–educational quantity distinction and also demonstrates the striking lack of data on processes and outcomes. Even after decades of effort, most education indicators focus on inputs, with an extreme dearth of process measures. These input measures have serious problems with comprehensiveness, comparability, accuracy, and reliability. Output measures, too, are in short supply. In particular, assessing the quality of education has been difficult, and most developing countries have no internationally comparable data on quality.

Relevant, timely, accurate, and reliable data are essential underpinnings of evidence-based policymaking. Such policymaking is more rational and transparent than decision making based on power, influence, and hunches. Good data, in conjunction with careful analyses, not only point the way to effective policies, they are also be a powerful safeguard against unintended consequences of interventions to promote educational access and quality. Unfortunately, in the area of primary and secondary education, the promise of evidence-based policymaking will not be realized without substantial changes in the nature and quality of the data collected.

Having examined the data at hand, I find that despite their limitations, the UNESCO, Barro-Lee, and Cohen-Soto datasets suggest three main conclusions about global progress toward universal basic and secondary education.

First, more children are being enrolled in primary education, although not all of these children are actually going to school or receiving a quality education. Although primary enrollment has reached near-universal levels in some developing regions, secondary level access remains weak throughout the developing world. Attainment and completion figures are low outside the developed world at both primary and secondary levels.

Second, although some developing regions, particularly Latin America/Caribbean and East Asia/Pacific, show progress toward improving access to education, others, particularly Sub-Saharan Africa and South Asia, lag on every measure.

Third, more girls are gaining access to education, but gender disparity remains strong in many developing countries. Equality of access is particularly poor at the elementary level in South Asia and in Africa, but also in East Asia/Pacific despite higher overall levels of access.

These basic indicators of progress in educational expansion are further refined by the TIMSS and PIRLS measures of educational quality. Although data are scant, it appears, as noted above, that the quality of education remains poor in most developing countries when compared with the developed world.

For the moment, though, some of the most straightforward estimates—such as the fact that more than 260 million secondary-school-age students do not attend school—should be enough to motivate Herculean efforts to address the world's education problems.

OBSERVATIONS ON DATA

Inconsistencies, both between the Barro-Lee and Cohen-Soto datasets and within each when data are extrapolated for the 15–24 year-old cohort, impair the ability to draw any firm conclusions from these data. These problems create significant concerns about the quality of data that are currently available for assessing progress toward universal basic and secondary education. Other datasets, including the work of Bruns et al. (2003), may provide a clearer picture for policymakers in the future.

A comparison of countries based on indicators of educational quality is problematic for a different reason. At present, few developing countries take part in TIMSS, PIRLS, and other standardized tests. Those that do participate tend to score much lower than OECD countries, but it is difficult to build a clear global picture of educational quality based on so few participants.

Data on educational processes could theoretically facilitate generalizations across countries or regions regarding the conditions that produce high-quality education. The fragmentary state of these data makes any conclusions difficult.

Overall, more work is necessary on the mechanisms linking inputs, processes, and outputs to down-the-line consequences.

QUALITY VS. QUANTITY

It appears that when defining educational development plans and strategies, developing countries must decide whether to emphasize the quantity or quality of education. Duraisamy et al. (n.d.) provide a detailed case study of educational expansion in Tamil Nadu, India. They show that expansion had a deleterious effect on quality and suggest that better management of public schools and the use of private resources (both allowing new private schools and encouraging private funds to help public and private schools) can partially mitigate this effect. The authors point out that such a policy would also require redirecting public funds toward schools in poor areas, where parents lack funds.

Various paths toward improving quality and quantity are possible. For example, initial emphasis could be on universal access, with the possibility that quality may suffer. If class sizes increase, facilities may become overburdened, and teachers' effectiveness may decrease. Another alternative—prioritizing high quality in the early phases—would likely make universal access more difficult. The introduction of fees for texts or supplemental materials, or increased investment in existing schools[61] and teaching staffs without expanding their size, may come at the expense of serving new populations.

One could imagine the stimulation of virtuous cycles in which quality improvements also facilitate expansion. Kremer et al. (1997) document that supplying textbooks and uniforms is associated with lower dropout rates and with additional students being attracted to a school. Such measures, moreover, may be less expensive than lowering student-teacher ratios. Similarly, investment in new schools can both reduce existing classroom crowding, likely improving quality, and provide capacity to absorb new students.

Mingat and Tan (1998) find that countries (in reasonably homogeneous income strata) vary widely in the quality-quantity trajectories they pursue. They also state that countries that focus on quality do so mainly by increasing the teacher-pupil ratio at the expense of access. They find that achieving higher teacher-pupil ratios seems not to be valuable (at least, when a country's ratio is similar to those already in place in most developing countries), which means that there is little to be gained by de-emphasizing access.[62] However, Behrman and Birdsall (1983) point out that quality does seem to matter from the standpoint of earnings gains. The possibility that there are quality thresholds below which increased quantity is meaningless remains largely unexplored.

An examination (not reported herein) of more up-to-date information than that given by Mingat and Tan (1998) is consistent with this view. Cross-country regression analysis shows no association between educational quality (i.e., test scores) and access/quantity (i.e., primary or secondary enrollment rates), controlling for the general state of development (i.e., income per capita or life expectancy). The policy implication of this result is that access should not be sacrificed for improved teacher-pupil ratios. Unlike Mingat and Tan, this analysis does not find any evidence of a negative association between teacher-pupil ratios and school enrollment rates.

The paucity of data on educational quality inhibits meaningful inferences about the tradeoff between educational quality and quantity. This information could be extremely useful in helping countries to circumvent the barriers to long-run improvements in quality and quantity and to identify the best short- and medium-run steps along the way.[63]

61. Heyneman (2004) points out the enormous range of non-salary expenditures that countries make in schools. In general, countries that spend more achieve higher quality; however, the efficiency of such investments varies widely across countries.

62. Put another way, there is a trade-off between access and teacher-pupil ratios (negatively sloped iso-income curves), but there is no trade-off between access and test scores (flat iso-income curves) because the higher teacher-pupil ratios do nothing to boost test scores.

63. An excellent compendium of issues and new thinking on the trade-off between quality and quantity in secondary education, emphasizing the need for each country to craft solutions that are appropriate for its own circumstances, is Chapter 3 of World Bank (2005).

OBSTACLES TO BETTER DATA

This analysis of existing methods for assessing progress toward universal basic and secondary education suggests that recognition of the importance of statistics and indicators has increased over the past decade. Nevertheless, three major obstacles remain.

First, continued capacity building is required in many developing countries where data compilation remains difficult. The availability of key quantitative measures, such as net enrollments, for the developing world has improved since Jomtien and the foundation of UIS in 1999 and will continue to grow. Indeed, UIS suggests that much of the information missing from its datasets is now for OECD countries.

Second, as noted, governments and school systems often face disincentives to provide accurate information. In some cases, schools may inflate data such as enrollments in order to meet political or financial targets. For example, comparison of Demographic and Health Surveys and UNESCO data shows the latter produce consistently higher enrollment estimates (Lloyd and Hewett, 2003). In many Sub-Saharan African countries, the difference may be due to political pressure on administrations.

These two issues lead to a third: the tension between useful information at the country level and data that are useful for a global picture. If developed countries, with near-universal access to education, believe that published global educational information is out of date or measures only the most basic facets of education, they may reasonably prioritize their efforts elsewhere. At the same time, if developing countries believe that global educational information is increasingly focused on more complex issues of quality, they may naturally decide to focus any data-related efforts on their own primary areas of concern: access and equity.

GETTING BETTER DATA

Broadening the Scope of the Data

At present, measurement of educational systems on a global level focuses on access and completion, and to a lesser extent on competencies. There is little emphasis on other key inputs (such as budgets, length of school day, and school infrastructure) and processes (such as types of schools, curricular content, and accreditation/oversight practices).

Work toward achieving a broader perspective on educational inputs and results is already taking place in some regions. For example, the work of the Partnership for Educational Revitalization in the Americas (PREAL) in Latin America includes the presentation of data on public expenditure per student, as well as a regional comparison of a range of other indicators. The recent PREAL report card for Central America and the Dominican Republic included scores for testing, equity (including access for poor students and rural populations as well as by gender), decentralization of the educational system, teacher training and incentives, educational standards, and assessment (PREAL, 2003).

Institutionalizing Commitment to Progress in Data Quality

Capacity building is still needed in some developing countries to create the ability to deliver high-quality information on education, but national political considerations provide powerful disincentives to focus on the delivery of educational indicators. However, education is one of the largest public investments made by any administration. On those grounds alone, it is vital that evaluation be accurate and timely.

The disparate interests of various national governments impede international agencies in their efforts to improve international data quality. There is continued improvement; key organizations, such as the World Bank and the UNESCO Institute for Statistics, are working together to develop a universal standard for reporting and measurement, focusing their efforts and resources on working with countries.[64] On the other hand, there is a danger here. Because the World Bank and other donors have encouraged or required that countries meet certain standards, they may tacitly encourage countries to misrepresent their accomplishments when results are less than hoped for. Placing these institutions in the role of ensuring statistical integrity is problematic.

AVENUES FOR FURTHER RESEARCH: NEW DATA AND NEW VIEWS OF EXISTING DATA

Further data-oriented research might yield important new insights relevant to universal basic and secondary education. Examples are:

- A study of the differences within individual countries. What patterns and trends are evident, and what, if anything, do they tell policymakers beyond what is already obvious?
- A study of countries or states that have improved education enormously—such as Cuba, Kerala (India), and Sri Lanka—without the economic successes that typically accompany educational achievement.
- A study of whether there is a trade-off between improving educational quality and increasing its quantity. The quality of children's experiences in the classroom depends on various process-level factors, including student-teacher ratios, teacher training, pedagogical styles, curricular relevance, the adequacy of school facilities and their maintenance, and attention to health and safety. Some work that defines and assesses data on these factors has been carried out by Duraisamy et al (n.d.), Heyneman (2004), Jones and Gingrich (1968), and Kremer et al. (1997).

64. The UNESCO Institute for Statistics, for example, is working on the Fast Track Initiative of Education for All, which aims to improve data for participating countries through a program for building statistical capacity. It has also produced a data quality framework, working in cooperation with the World Bank and the International Monetary Fund. Another effort to improve education data internationally is the publication, *The OECD Handbook for Internationally Comparative Education Statistics: Concepts, Standards, Definitions and Classifications*.

- A study of how various levels of education relate to countries' needs at different stages of development. In particular, it would be useful to assemble data to test further the conclusion of Jamison and Lau (1982) that higher levels of basic and secondary education correlate well with improved productivity.

FINAL REFLECTIONS

Ten years ago, as noted above, Puryear observed that the world had developed little capacity to determine the worth of its huge investment in education. Annual public expenditure on education (including tertiary level) is now approximately $1.5 trillion, of which approximately $250 billion is spent in developing countries (UNESCO, 2000). In this review of some of the major available datasets on education, it appears that Puryear's 1995 assessment still rings true. There are significant gaps in data on enrollment, attainment, and completion. There are huge deficiencies in the measurement of educational quality. Process indicators are severely lacking. Consistency across and within datasets is disturbingly low. Variations in reporting across education systems, such as differences in what age groups belong to what education level, further complicate analysis.

Happily, recent efforts by the UNESCO Institute for Statistics are blowing a much-needed fresh wind through national agencies and independent researchers who report, gather, and analyze educational data. UIS has made significant strides toward overcoming the historic lack of coordination, underfunding, conflicting incentives, collect-and-file-mentality, and lack of dialog with end users that have long characterized the field of educational data. There is reason to hope that analysts who have at times in the past operated under the illusion that they are using reliable data will soon have genuinely reliable data at hand.[65]

Despite their longstanding limitations, the available data do seem to be strong enough to support some general statements and provide a basis for spotting issues and identifying policy directions. Evidence-based policymaking requires much more complete and reliable data, however. Not having these data constitutes a missed opportunity to capitalize on the enormous investment the world makes in education and impedes recognition of education's importance in the overall process of development.

65. Other recent efforts to gather and analyze data include The Global Education Database, which is compiling data from UNESCO and Demographic and Health Surveys, and the World Bank EdStats website, which compiles data from different sources and provides information on enrollment and attainment by household characteristics.

Appendix A

Table 1: Primary and Secondary Net Enrollment, Total and by Gender, for most recent year (1998–2005)

	Primary				Secondary			
	Total	Male	Female	Gender Gap (M–F)	Total	Male	Female	Gender Gap (M–F)
World (simple average)	86	87	85	2	64	63	64	-1
Region (simple average)								
East Asia and the Pacific	90	91	89	2	56	54	56	-2
Eastern Europe and Central Asia	90	90	89	1	85	84	85	0
Latin America and the Caribbean	92	93	92	1	69	66	71	-5
Middle East and North Africa	85	87	82	5	55	57	53	4
South Asia*	79	81	76	5	48	45	51	-6
Sub-Saharan Africa	70	72	66	6	28	30	27	4
Developed Countries	95	95	95	0	86	85	87	-2
Country								
Albania	95	96	94	2	77	76	78	-2
Algeria	95	96	94	2	67	65	69	-4
Andorra	89	88	90	-2	71	69	74	-5
Angola	61	66	57	9	–	–	–	–
Anguilla	95	94	96	-2	99	100	97	3
Argentina	–	–	–	–	81	79	84	-5
Armenia	94	95	93	2	83	82	85	-3
Aruba	99	100	98	2	75	72	79	-7
Australia	97	96	97	-1	87	86	88	-2
Austria	90	89	91	-2	89	89	89	0
Azerbaijan	80	81	79	2	76	77	75	2
Bahamas	86	85	88	-3	76	74	77	-3
Bahrain	90	89	91	-2	87	84	90	-6
Bangladesh	84	82	86	-4	44	42	47	-5
Barbados	100	100	100	0	90	90	90	0
Belarus	94	95	94	1	85	83	86	-3
Belgium	100	100	100	0	97	97	98	-1
Belize	99	98	100	-2	69	67	71	-4
Benin	58	69	47	22	19	26	12	14
Bolivia	95	95	95	0	71	72	71	1
Botswana	81	79	83	-4	54	50	57	-7
Brazil	97	98	91	7	75	72	78	-6
Bulgaria	90	91	90	1	87	88	86	2
Burkina Faso	36	42	31	11	9	11	7	4
Burundi	57	62	52	10	9	10	8	2
Cambodia	93	96	91	5	24	30	19	11
Canada	100	100	100	0	94	94	94	0
Cape Verde	99	100	98	2	58	55	61	-6
Chad	61	72	49	23	12	17	6	11
Chile	85	85	84	1	81	80	81	-1

	Primary				Secondary			
	Total	Male	Female	(M–F)	Total	Male	Female	(M–F)
China**	95	94	95	-1	–	–	–	–
Colombia	87	88	87	1	55	53	58	-5
Comoros	55	59	50	9	–	–	–	–
Congo, Republic of the	54	55	53	2	–	–	–	–
Costa Rica	90	90	91	-1	53	50	55	-5
Côte d'Ivoire	61	67	54	13	21	27	15	12
Croatia	89	90	89	1	87	86	87	-1
Cuba	96	96	95	1	86	86	86	0
Cyprus	96	96	96	0	93	91	94	-3
Czech Republic	87	87	87	0	90	89	92	-3
Denmark	100	100	100	0	96	94	98	-4
Djibouti	36	40	32	8	21	25	17	8
Dominica	81	83	79	4	92	86	98	-12
Dominican Republic	96	99	94	5	36	30	41	-11
Ecuador	100	99	100	-1	50	50	51	-1
Egypt	91	93	90	3	78	80	76	4
El Salvador	90	90	90	0	49	48	49	-1
Equatorial Guinea	85	91	78	13	–	–	–	–
Eritrea	45	49	42	7	22	25	18	7
Estonia	95	95	94	1	88	87	90	-3
Ethiopia	51	55	47	8	18	23	13	10
Fiji	100	100	100	0	76	73	79	-6
Finland	100	100	100	0	95	94	95	-1
France	99	99	99	0	94	93	95	-2
Gabon	78	79	78	1	–	–	–	–
Gambia	79	79	78	1	33	39	27	12
Georgia	89	89	88	1	78	77	78	-1
Germany	–	–	–	–	88	88	88	0
Ghana	63	64	62	2	36	39	33	6
Greece	99	99	99	0	86	85	87	-2
Grenada	84	89	80	9	99	100	99	1
Guatemala	87	89	86	3	30	30	29	1
Guinea	65	73	58	15	21	28	13	15
Guinea-Bissau	45	53	37	16	9	11	6	5
Guyana	99	100	98	2	75	58	92	-34
Honduras	87	87	88	-1	–	–	–	–
Hong Kong, SAR	98	98	97	1	74	72	75	-3
Hungary	91	91	90	1	94	94	94	0
Iceland	100	100	99	1	86	84	88	-4
India	88	90	85	5	–	–	–	–
Indonesia	92	93	92	1	54	54	54	0
Iran, Islamic Republic of	86	88	85	3	–	–	–	–
Iraq	91	98	83	15	33	40	26	-14
Ireland	96	95	97	-2	83	80	87	-7
Israel	99	99	99	0	89	89	89	0
Italy	99	100	99	1	91	91	92	-1
Jamaica	95	94	95	-1	75	74	77	-3
Japan	100	100	100	0	99	99	100	-1
Jordan	92	91	93	-2	80	79	81	-2
Kazakhstan	91	92	91	1	87	87	87	0

	Primary				Secondary			
	Total	Male	Female	(M–F)	Total	Male	Female	(M–F)
Kenya	66	66	66	0	25	25	24	1
Kuwait	83	82	84	-2	77	75	79	-4
Kyrgyzstan	89	91	88	3	–	–	–	–
Lao People's Democratic Republic	85	88	82	6	35	38	32	6
Latvia	86	86	85	1	88	88	88	0
Lebanon	91	91	90	1	–	–	–	–
Lesotho	86	83	89	-6	22	18	27	-9
Liberia	70	79	61	18	18	23	13	10
Lithuania	91	91	91	0	94	94	94	0
Luxembourg	90	90	91	-1	80	77	83	-6
Macao, China	87	88	86	2	74	71	78	-7
Macedonia, TFYR	91	91	91	0	81	82	80	2
Madagascar	79	78	79	-1	11	11	12	-1
Malawi	100	–	–	–	29	32	26	6
Malaysia	93	93	93	0	70	66	74	-8
Maldives	92	92	93	-1	51	48	55	-7
Mali	44	50	39	11	–	–	–	–
Malta	96	96	96	0	87	86	88	-2
Marshall Islands	76	77	75	2	65	64	66	-2
Mauritania	68	68	67	1	16	18	14	4
Mauritius	97	96	98	-2	74	74	74	0
Mexico	99	99	100	-1	63	61	64	-3
Mongolia	79	78	80	-2	77	72	83	-11
Morocco	90	92	87	5	36	38	33	5
Mozambique	55	58	53	5	12	14	10	4
Myanmar	84	84	85	-1	35	36	34	2
Namibia	78	76	81	-5	44	39	50	-11
Nauru	81	80	82	-2	–	–	–	–
Nepal	70	75	66	9	–	–	–	–
Netherlands	99	100	99	1	89	88	89	-1
Netherlands Antilles	88	86	91	-5	63	60	67	-7
New Zealand	100	100	100	0	93	93	95	-2
Nicaragua	85	86	85	1	39	36	42	-6
Niger	38	45	31	14	6	7	5	2
Nigeria	67	74	60	14	29	32	26	6
Niue	99	99	98	1	94	95	93	2
Norway	100	100	100	0	96	96	97	-1
Oman	72	72	72	0	69	69	70	-1
Pakistan	59	68	50	18	–	–	–	–
Palau	96	98	94	4	–	–	–	–
Palestinian Autonomous Territories	91	91	91	0	84	82	86	-4
Panama	100	100	99	1	63	60	66	-6
Papua New Guinea	74	79	69	10	24	27	21	6
Paraguay	89	89	89	0	51	50	53	-3
Peru	100	100	100	0	69	70	68	2
Philippines	94	93	95	-2	59	54	65	-11
Poland	98	98	98	0	91	90	93	-3
Portugal	100	100	99	1	85	81	89	-8
Qatar	94	95	94	1	82	80	85	-5
Republic of Korea	100	100	100	0	88	88	88	0

	Primary				Secondary			
	Total	Male	Female	(M–F)	Total	Male	Female	(M–F)
Republic of Moldova	79	79	79	0	69	68	70	-2
Romania	89	89	88	1	81	79	82	-3
Russian Federation	90	89	90	-1	–	–	–	–
Rwanda	87	85	88	-3	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	97	94	100	-6
Saint Lucia	99	99	100	-1	76	68	85	-17
Saint Vincent and the Grenadines	90	90	90	0	58	56	61	-5
Samoa	98	99	96	3	62	59	65	-6
Sao Tome and Principe	97	100	94	6	29	32	26	6
Saudi Arabia	54	55	54	1	53	54	52	2
Senegal	69	71	66	5	–	–	–	–
Serbia and Montenegro	96	96	96	0	–	–	–	–
Seychelles	100	100	99	1	100	100	100	0
Slovakia	86	85	86	-1	88	88	88	0
Slovenia	93	94	93	1	93	93	94	-1
South Africa	89	89	89	0	62	59	65	-6
Spain	100	100	99	1	96	94	98	-4
Sudan	46	50	42	8	–	–	–	–
Suriname	97	96	98	-2	64	54	74	-20
Swaziland	75	75	75	0	32	29	36	-7
Sweden	100	100	99	1	99	99	100	-1
Switzerland	99	99	99	0	87	89	84	5
Syrian Arab Republic	98	100	96	4	43	44	41	3
Tajikistan	94	97	91	6	83	90	76	14
Thailand	85	87	84	3	–	–	–	–
Togo	91	99	83	16	27	36	17	19
Tonga	100	100	100	0	72	67	77	-10
Trinidad and Tobago	91	91	90	1	72	69	75	-6
Tunisia	97	97	97	0	64	61	68	-7
Turkey	86	89	84	5	–	–	–	–
Turks and Caicos Islands	73	74	73	1	79	78	80	-2
Uganda	–	–	–	–	16	17	16	1
Ukraine	84	84	84	0	85	84	85	-1
United Arab Emirates	83	84	82	2	71	70	72	-2
United Kingdom	100	100	100	0	95	93	97	-4
United Republic of Tanzania	82	83	81	2	5	5	4	1
United States	92	92	93	-1	88	88	89	-1
Uruguay	90	90	91	-1	73	70	77	-7
Vanuatu	94	93	95	-2	28	27	28	-1
Venezuela	91	90	91	-1	59	55	64	-9
Viet Nam	95	98	92	6	65	–	–	–
Yemen	72	84	59	25	35	47	21	26
Zambia	68	69	68	1	23	25	21	4
Zimbabwe	79	79	80	-1	34	35	33	2

* Due to lack of data, this secondary education average does not include data from India or Pakistan.

** Primary net enrollment data for China from UNESCO 2006 EFA Global Monitoring Report.

Sources: UNESCO online data, http://www.uis.unesco.org (Statistical Tables, accessed March 2006).

Appendix B

METHOD FOR CALCULATING THE CURRENT NUMBER OF UNENROLLED CHILDREN

The method described below was used to estimate the number of children of primary and secondary age who are not currently enrolled in school.

The number of primary-school-age children for each country is calculated assuming a homogeneous population distribution. Using the average of 2000 and 2005 population data from *World Population Prospects: The 2004 Revision* (UN, 2004) for children in the 5–9, 10–14, and 15–19 age groups, I divide the total for each age group by 5. The resulting number represents the population of a one-year age group. Using UNESCO data for the starting and ending ages of primary education, I find the number of primary-school-age children by summing the population figures for the one-year age groups that correspond to the years of primary school. (For example, to determine the number of students in a primary age range of 6 to 11, I multiply 4 times the figure for a one-year age group of the 5–9 population and add this to 2 times a figure for a one-year age group of the 10–14 population.) The population of secondary-school-age children is calculated using the same approach.

The most recent available net enrollment rates (NER) and gross enrollment rates (GER) from UNESCO[1] are used for both primary and secondary data. To estimate missing NER, I use a regression of NER on GER, per capita GDP, and under-5 mortality rates, because NER is highly correlated with these indicators (correlations for primary school are respectively: 0.73, -0.69, 0.47; for secondary school, they are: 0.94, -0.84, 0.63). Per capita GDP data and under-5 mortality rates are taken from *World Development Indicators 2005* (World Bank, 2005). For countries without per capita GDP and/or mortality data, regressions using only GER and the other available data are used. (Thus, if only GER and per capita GDP are available, a regression of NER on GER and per capita GDP is used. Similarly, if only GER and mortality rates are available, a regression of NER on GER and mortality is used. Finally, if neither per capita GDP nor mortality is available, a regression of NER on GER is used to estimate NER.) All estimated NERs are capped at 100 percent, and are capped to be lower than reported GER.

I estimate the number of enrolled primary-age children by multiplying the most recent available primary NER by the population of primary-age children. Perhaps because the various data sets are from different years or simply because of inaccurate data, the estimated enrolled primary-age population for

1. http://www.uis.unesco.org/ev.php?URL_ID=5187&URL_DO=DO_TOPIC&URL_SECTION=201

some countries is larger than UNESCO's reported total primary school enrollment. To correct for this overestimation, for any country whose estimated primary-age enrollment is more than 1 percent larger than the reported primary school enrollment, I multiply the reported primary school enrollment by the average ratio of estimated-to-reported primary-age enrollment for all other countries to estimate enrolled primary-age students. This correction is also used for secondary data.

I estimate the number of unenrolled children of primary age by subtracting the number of primary-age enrolled students from the population of primary-age children.

To account for the 19 small countries without any available NER or GER data, the final world number for unenrolled children is increased proportionally by the percentage that children age 5–9 from these countries represent of the total world population of children age 5–9.

For any country with primary but not secondary enrollment data, a regression of secondary enrollment rates on primary enrollment rates and per capita GDP is used to estimate secondary enrollment rates.

The number of secondary-age students enrolled in school is calculated by adding the estimated number of students in secondary school to the number of secondary-age students in primary school.

To calculate the number of secondary-age children in secondary school, I multiply the secondary NER by the population of secondary-age children, and then adjust these calculations using the same methodology used for primary-age children. Making the assumption that students enrolled in primary school who are not primary school age are of secondary school age, I calculate the number of secondary-age children in primary education by subtracting the primary NER [number of students of primary age in primary school/population of primary-school-age children] from the primary GER [number of all students in primary school/population of primary-school-age children] and multiplying this difference by the population of primary-school-age children.

As with the calculations for primary-age children, the number of unenrolled secondary-age students is calculated by subtracting the number of enrolled students from the total number of children who are secondary school age. In the secondary school calculations, this number is negative for some countries, which cannot be correct. There are various possible explanations for this result. First, the simplifying assumption of a homogeneous population distribution within age groups may not hold. Furthermore, the assumption that students in primary school who are not primary age are by default secondary age may be incorrect (as some may be younger than primary age or older than secondary age), and it would lead to an overestimation of the number of secondary-age students enrolled in primary school. Thus, large differences between primary gross and net rates may lead to inaccurate estimates of enrolled secondary-age students; one cannot determine the age of students enrolled in primary school who are not of primary age. Finally, and in my judgment most important, inaccurate data may account for the observed discrepancy.

Because the true number of unenrolled children cannot be negative, any negative value is adjusted to zero. This adjustment, which applies to nine countries, results in a change of less than 1 percent in the estimate of the number of unenrolled secondary-age children (and approximately three-quarters of the total adjustment is due to the figures from Brazil). Nevertheless, the fact that the unadjusted estimate is negative for some countries (and thus stands out in the calculations) suggests that there may be less-visible data problems with other countries.

METHOD FOR CALCULATING THE NUMBER OF UNENROLLED CHILDREN IN 2015

The method described below was used to project the number of unenrolled children of primary and secondary age in 2015.

The number of students of primary school age for each country is calculated using the same approach as the calculations for current number of students (described above), with the projected 2015 population data from *World Population Prospects: The 2004 Revision* (UN, 2004) substituted for the 2000/2005 data.

Using a linear projection of available NER and GER since 1990—taken from *World Development Indicators 2005* (World Bank, 2005)—for each country, I forecast 2015 NER and GER for both primary and secondary education. For countries with only one available data point, this data point is used as the 2015 rate. To project NER for countries without any NER data, I predict 2015 NER from the projected 2015 GER, per capita GDP, and under-5 mortality rates. To avoid the increasing uncertainty that would be introduced by using regression coefficients based on 2015 estimates, I use the coefficients from the NER on GER, per capita GDP, and under-5 mortality rates regression described above for the current-enrollment calculations. Thus, I assume that the relationship between NER and GER, per capita GDP, and under-5 mortality for 2005 would remain the same for 2015.

To avoid unrealistic projected GERs that would in some instances result from countries experiencing rapid changes in enrollment and/or those with limited data, I cap projected 2015 GER at the higher value of 120 for primary (and 100 for secondary) and the latest available GER. Projected NER is limited to values between 0 and 100, as numbers beyond this range are by definition impossible.

I estimate the number of unenrolled primary- and secondary-age children using the same methodology as before, except that I do not adjust for the difference between estimated enrollment numbers and reported enrollment numbers (as there are no reported 2015 numbers). Any negative value for the number of unenrolled students is set to zero.

To account for the 34 countries without any available NER or GER data, the final world value for unenrolled primary-age students is increased proportionally by the share of the world population age 5–9 that children from these countries represent. Similarly, the share of world population age 15–19 represented by these countries is used for secondary school calculations.

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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.

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