Human Capital as Key to Global Development

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Introduction

The main message of this presentation is in its title: The improvement of human capital measured through improved education of broad segments of the population is not only an end in itself in terms of empowerment of people, but it is also a key driver of several other important dimensions of development. People are not just numbers or objects of development policies. People are also the agents of development. They are the carriers of culture, the producers of civilizations and technologies, of wealth and infrastructures, and in cooperation they produce quality of life for each other within a given natural environment. But people can also endanger and destroy the lives of others directly, e.g., through wars, and indirectly through influencing the conditions for life. The wellbeing of people is the ultimate criterion for what constitutes successful and sustainable development.

This dual role of people as agents of development on the one hand, and of human wellbeing as the criterion for development on the other, must be at the heart of any discussion of development.

The main point of this presentation is that it is not only the number of people, together with their age, sex and spatial distributions, that matters, but that their skills (human capital) make a decisive difference both for the advancement of development and human wellbeing, as well as for the resilience to threats of this wellbeing.

Structure of the Presentation

The presentation is divided into three parts: First, we summarize what is known about current and likely future demographic trends. This is based on an updated version of IIASA's 2001 probabilistic world population projections that appeared in *Nature* in 2001 under the title "The end of world population growth" (Lutz et al. 2001) and has now been accepted for publication in the same journal in 2007 (Lutz et al. 2007a). In the second part, we will add educational attainment as a human characteristic in addition to age and sex, and present results of an exercise recently completed at IIASA in collaboration with the Vienna Institute of Demography (VID) to reconstruct past and project future levels of educational attainment for 120 countries (Lutz et al. 2007b). In the third part, we will present evidence illustrating the importance of human capital for development, including economic growth.

Part 1: Population Trends in the 21st Century: Expected end of world population growth and global ageing

IIASA's world population projections show that with a high probability of 85-90 percent, world population will reach a peak and start to decline over the course of the 21st century. This has given rise to the notion of the "end of world population growth" which was the title of our 2001 paper in *Nature* as well as a 2004 book giving more background and details about these projections (Lutz et al. 2004). In 2007 we produced a new update of these projections. These probabilistic projections reflect the uncertainty in all three factors affecting population change, namely, fertility, mortality, and migration (see also the presentation by Arnulf Gruebler on "Coping with uncertainties") while most other population projection exercises, such as the widely-used United Nations population projections, only reflect fertility uncertainty.

While the 20th century was the century of population growth (with the world population increasing from 1.6 to 6.1 billion – see Figure 1), the 21st century will be that of population ageing (with the proportion above age 60 increasing from currently 0.10 to 0.25-0.45 by 2100).

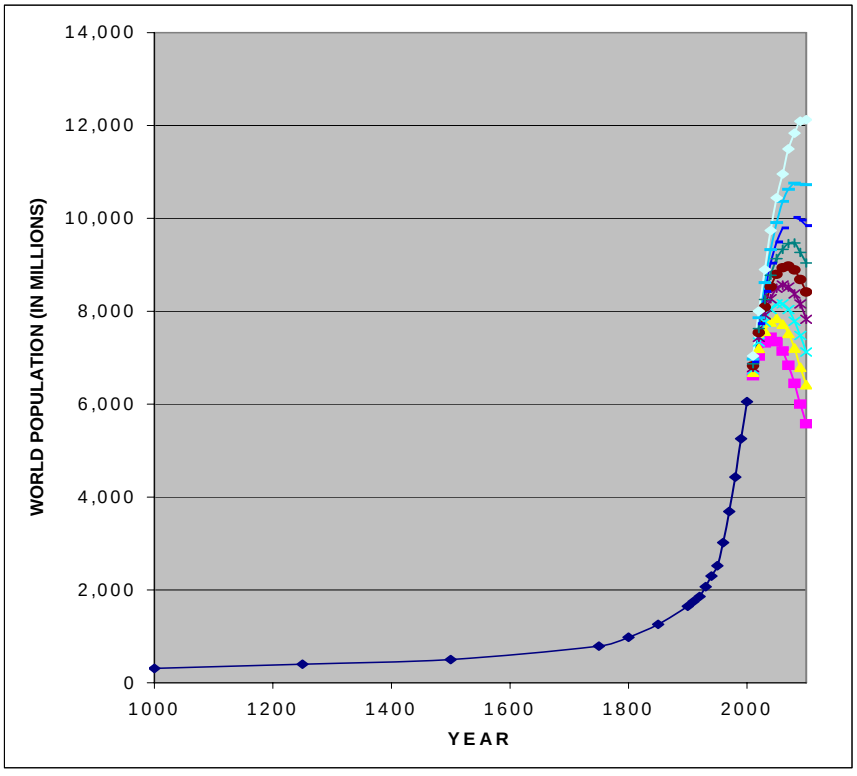

Figure 1. World population from the year 1000 to 2100 (different lines for 21st century show 0.1 fractiles of uncertainty distribution, i.e., 80 percent of the simulated cases lie between the top and bottom lines). Sources: UN (1973, 2005) for historical trends; Lutz et al. (2007a) for IIASA's probabilistic projections.

Today we live in a demographically-divided world, with some regions (Africa, Arab World) still growing very fast, while others (Europe, East Asia) are ageing rapidly, and some (Eastern Europe) are already shrinking. For instance, Figure 2a shows that in Sub-Saharan Africa, the

population is likely to more than triple in the next century, while the population of Eastern Europe (Figure 2b) is shrinking at a rate that could half the region's present population size by the end of this century.

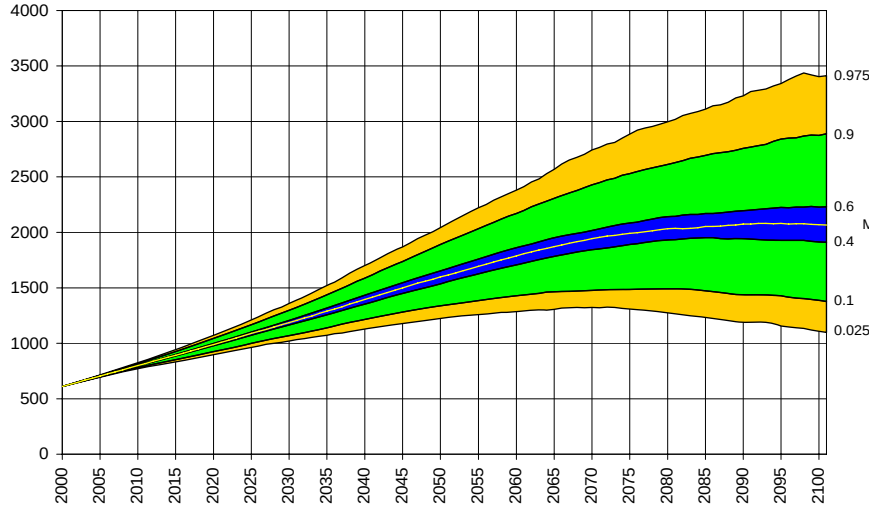

Figure 2a. 95 percent uncertainty range of future population size (in millions) in Sub-Saharan Africa, 2000-2100 (IIASA 2007 projections). Source: Lutz et al. (2007a).

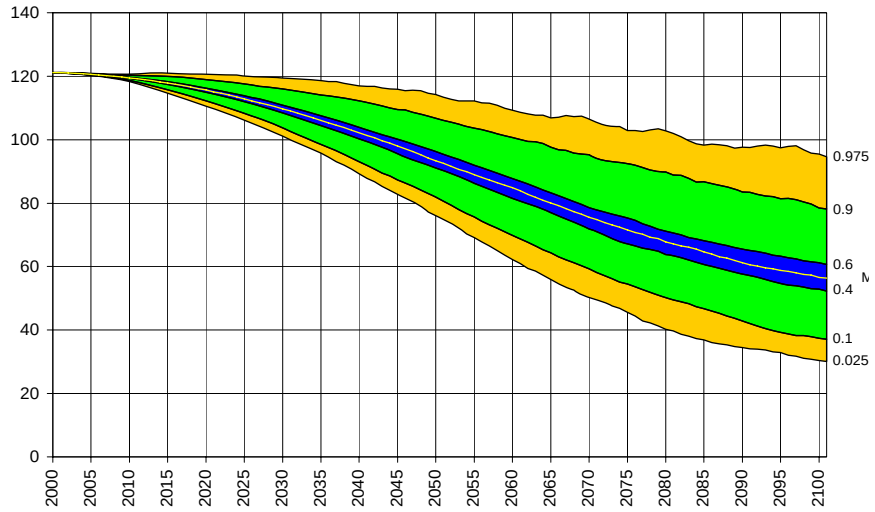

Figure 2b. 95 percent uncertainty range of future population size (in millions) in Eastern Europe, 2000-2100 (IIASA 2007 projections). Source: Lutz et al. (2007a).

While population ageing will be pervasive at the global level and in many world regions, there will be great differences in the level and pace of ageing. The differences will be great even among the developed countries. This can be seen, e.g., from the comparison of the proportion over 60 years of age in North America on the one hand, and the region of Japan, Australia and New Zealand on the other. Figure 3a shows that due to higher fertility and more immigration, ageing in North America is expected to be less dramatic than in the other region which is dominated by Japan (Figure 3b).

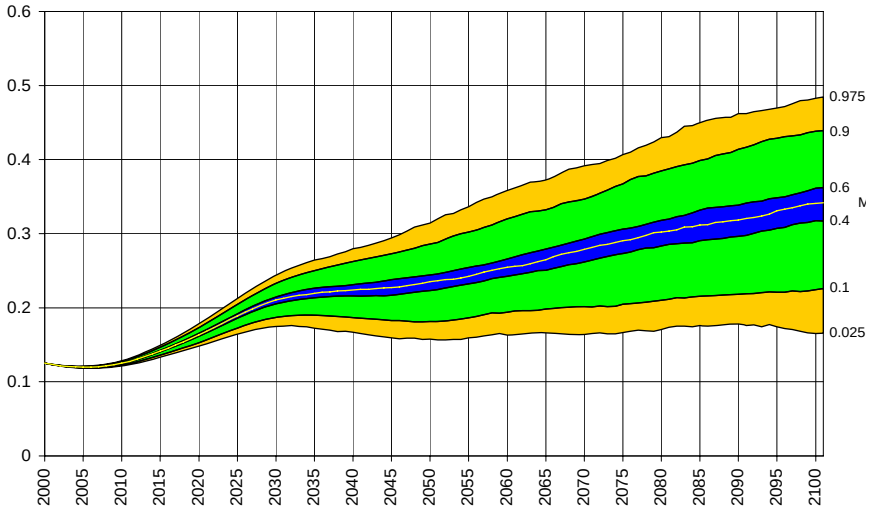

Figure 3a. Proportion 60 and over, North America, 2000-2100 (IIASA 2007 projections). Source: Lutz et al. (2007a)

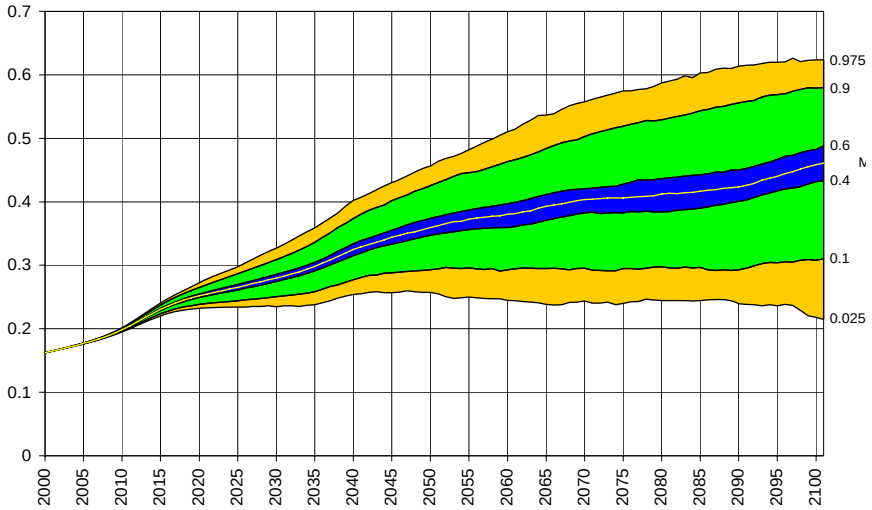

Figure 3b. Proportion 60 and over, Japan, Australia and New Zealand, 2000-2100 (IIASA 2007 projections). Source: Lutz et al. (2007a)

Part 2: Modeling the World's Growing Human Capital, 1970-2050

In the context of simultaneous, rapid ageing growth in some places and rapid population ageing and even shrinking in others, it is important not only to focus on quantitative dimensions of population size and age structure, but also to consider the "quality dimensions" of education and health. Levels of educational attainment can be readily measured for most countries and are of crucial importance, as will be discussed below. Here we define human capital as the number of people, their age structure and their education. Since objective indicators of health by age, sex and level of education are more difficult to obtain for large numbers of countries, we do not include them in this analysis where the focus is on educational attainment.

So far there have not been any consistent and globally comparable reconstructions of populations by age (five-year age groups), sex and levels of educational attainment, nor have there been projections for large numbers of countries. The methods of multi-state population dynamics that were developed at IIASA during the 1970s provide the appropriate tools for doing so.

While modeling the changing educational composition of the population is necessary for any consideration of the returns to investments in education, it is also directly relevant for the projections of the population trends themselves because fertility and mortality levels tend to greatly differ by level of education. When the educational composition of the population changes, this has impacts on the overall fertility and mortality levels in the population. In most conventional population projections by age and sex, only these structural changes are considered implicitly, e.g., in the projections made by the United Nations or the IIASA probabilistic projections mentioned above However, making the effects of these structural changes explicit can provide a much richer knowledge about past, present and likely future drivers of population change. Explicit information about the educational attainment distribution is also crucial because education is linked to many indicators of human wellbeing and development as will be shown in Part 3. Research in this field has so far been hindered because of the lack of good and consistent data. Our reconstructions and projections are trying to fill this gap.

Using demographic multi-state methods for back-projection along cohort lines, we produced a fully consistent, historical dataset by five-year age groups, sex and four educational attainment categories for 120 countries for 1970-2005 (see Figures 4a and 4b for the example India in 1970 and 2005).

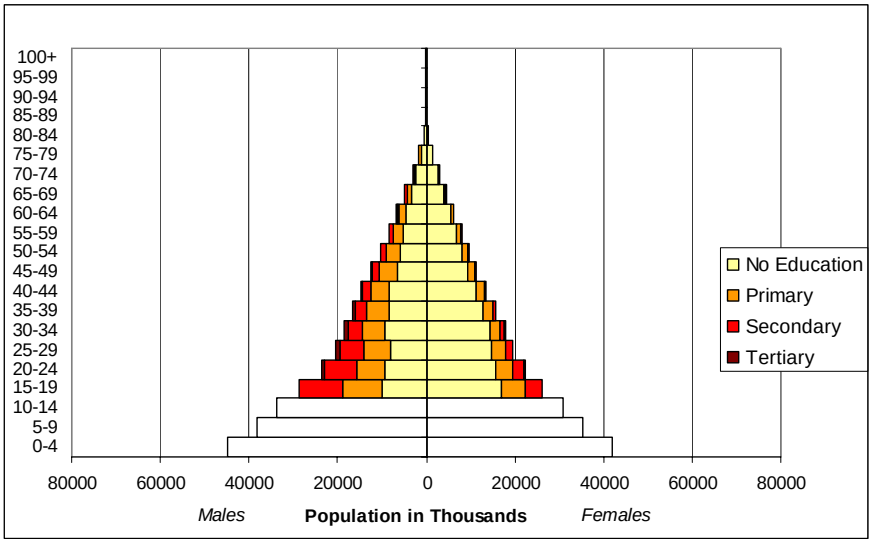

Figure 4a. Population by levels of education, India, reconstructed for 1970. Source: Authors' calculations.

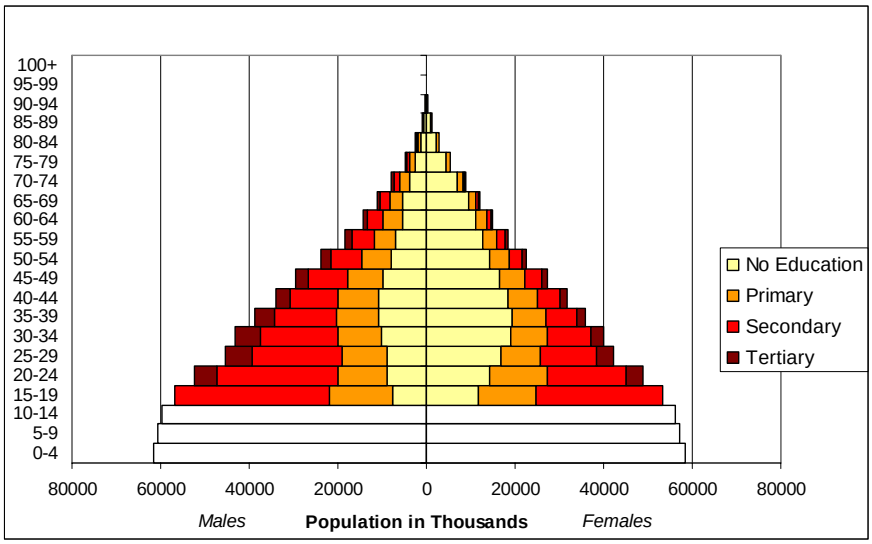

Figure 4b. Population by levels of education, India, 2005. Source: Authors' calculations.

This information about current educational attainment levels by age and sex and recent trends in educational attainment was then used together with assumptions on future fertility and mortality differentials by level of education to project levels of educational attainment for the 120 countries to 2050 based on a set of alternative scenarios showing, e.g., the possible impacts of achieving education goals (Millennium Development Goals (MDG) education objectives) on the future educational composition of the adult population (see Figure 5). The projections point to an important challenge that will be faced by many fast-growing countries, mostly in Africa, but also in South Asia, namely, that population growth is likely to hinder an increase in school enrolment rates as the school system capacity may not be able to cope with the growth in the number of children to be enrolled in school following the MDG.

The comparison between the two contrasting scenarios of reaching the ambitious education goals (Figure 5a) and simply keeping school enrolment rates constant (Figure 5b) illustrates the great momentum of changes in the educational composition of the adult population. Since education typically affects only the young population, it takes decades to translate improvements in schooling into improvements of the average educational attainment of the adult population.

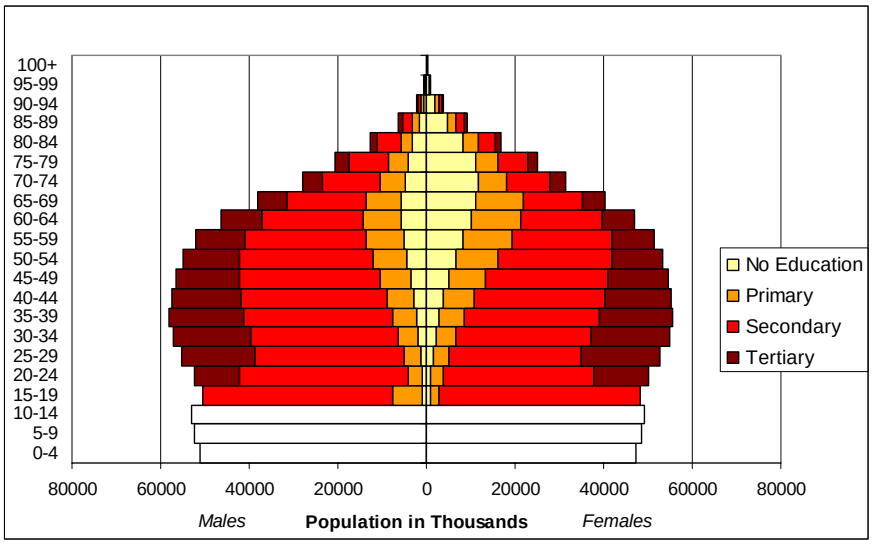

Figure 5a. Projections of population by levels of education, India, 2050, Goal scenario. Source: Authors' calculations.

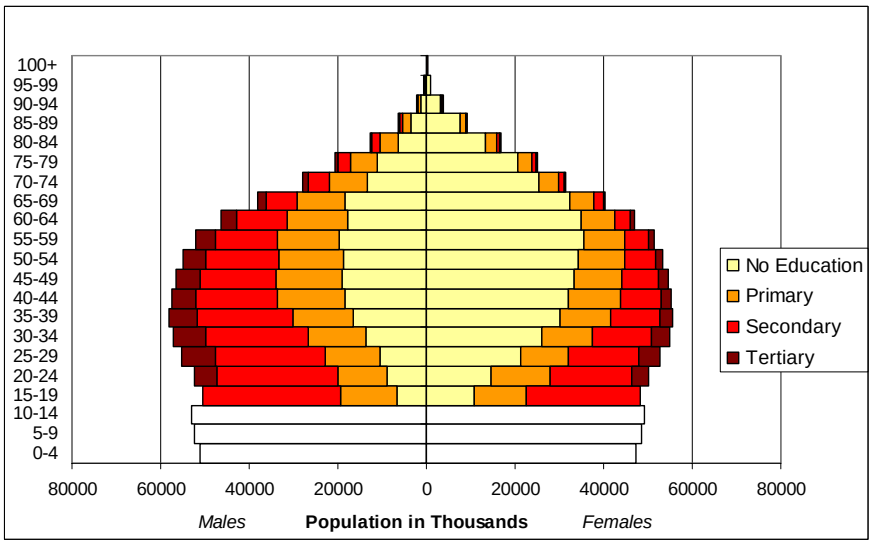

Figure 5b. Projections of population by levels of education, India, 2050, Constant Enrolment Rates scenario. Source: Authors' calculations.

The contrast between the greatly differing countries in the levels of population growth, given in the first part of this paper, also exists in the levels of educational attainment of the working-age population. The four graphs in Figure 6 show, on the same scale, the absolute numbers of the working-age population with four levels of education between 2005 and 2050 for four mega regions. It shows both the momentum of population and education growth. It shows that Europe and North America together have a much smaller work force than South Asia or the China region, yet they still dominate in terms of human capital. This will change over the coming decades when the China region will have more working-age people with secondary or tertiary education than Europe and North America together. South Asia will be even bigger in terms of people, but weaker in terms of human capital.

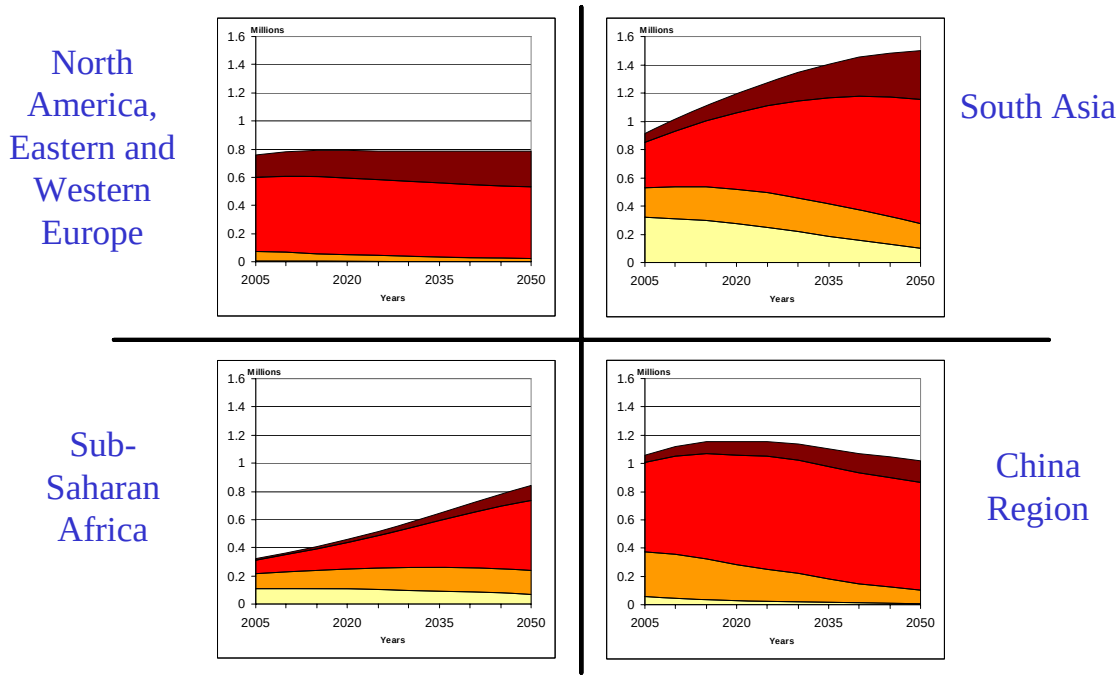

Figure 6. Levels of educational attainment of the population aged 15-64 in four mega regions, 2005-2050. Source: Authors' calculations.

Part 3: Human Capital, Economic Growth and Development

At the micro level, education enables individuals to improve their economic circumstances and leads to empowerment and to better health, fewer disabilities and higher life expectancy. At the macro level, education of broad segments of the population accelerates the demographic transition, particularly through declining mortality and fertility reduction (see Table 1). It is also likely to lead to increasing political and democratic stability, eliminate inequities and disparities within the society, and promote the acceptance of cultural diversity. Furthermore, education fosters economic growth. In terms of the Human Development Index (HDI) computed by the UNDP, education is one of the three components covered; it positively influences the two other components, which are life expectancy and income.

Table 1. Total fertility rates (number of children per woman) by women's highest educational attainment level. Source: ORC Macro (2007).

	No education (A)	Primary	Secondary and higher (B)	Difference (A)-(B)
Bolivia 2003	6.8	4.9	2.5	4.3
Ethiopia 2005	6.1	5.1	2.0	4.1
Nepal 2001	4.8	3.2	2.2	2.6
Armenia 2005	3.1		1.7	1.4

For many years economists studying economic growth have been puzzled by the fact that indicators of the human capital of a population do not consistently show significant positive coefficients as expected from theory. This lack of consistent empirical evidence on macro-level returns to education is in stark contrast to strong individual-level evidence that more education on average leads to higher income.

Most economic growth regressions so far have approximated human capital by only one variable, giving the mean years of schooling of the population above age 25. This indicator includes all elderly people beyond retirement age and therefore shows a much slower pace of improving average human capital than age-specific indicators for younger adults. In addition, the full distribution of educational attainment categories by age allows for important empirical studies about the relative importance of primary education as compared to secondary and tertiary in the course of development.

Using the newly-developed IIASA human capital dataset, several models were estimated in order to assess and quantify the importance of education and age structure on economic growth. The following points summarize the results obtained, which were tested systematically for robustness:

- By exploiting the demographic dimension of the education data, we show that human capital is better able to explain differences in income per capita across countries. In particular, differences in the education level of the younger age groups explain the differences in income per capita across countries significantly better than aggregate measures such as the education level of the entire adult population.

- In economic models, human capital is commonly assumed to be a crucial determinant of technology adoption. We find evidence that in developed countries, the education of the younger adults contributes significantly to the adoption of technology and therefore to GDP per capita growth in the long run.

- Using data on both developed and developing countries, we estimate a very general model of economic growth where education affects both (age specific) labor productivity and technology adoption. The results on productivity present robust empirical evidence that the highest positive elasticities correspond to the population with completed secondary education, in particular of the young age group (see Figure 7). On the side of indirect effects through technology, the results are significant for the older group with completed secondary education and the youngest group with completed tertiary education, and the elasticity increases with the level of development. This result can be interpreted as evidence for the two different ways of approaching the technological frontier: imitation (for which the old group with secondary education may be deemed responsible) and innovation (where the young group with tertiary education probably plays the most relevant role). This points to the necessity of expanding the MDG goal of universal primary education to “universal primary and secondary education” when the post-2015 goals are being defined. This argument was made earlier, but we can now support it with solid data and scientific analysis.

- Similarity of human capital endowments appear as a robust determinant of co-movement in income per capita in developed countries. This implies that the shape of the distribution of educational attainment by age modulates the diffusion of technological shocks across countries.

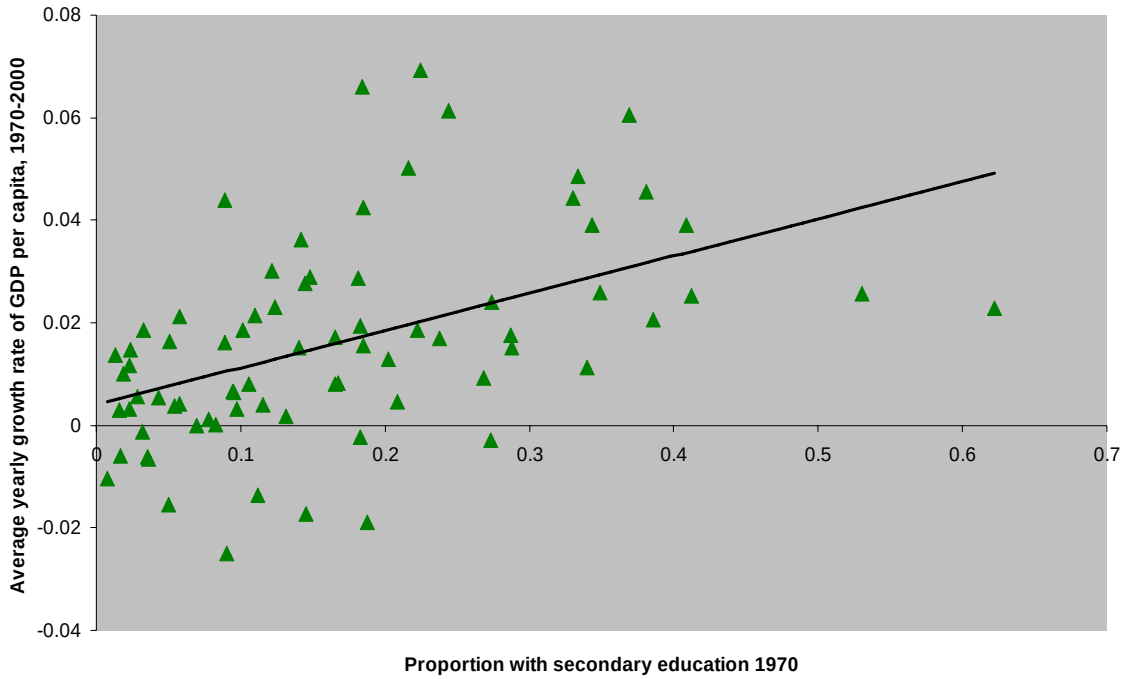

Figure 7. Relationship between proportion with lower secondary education in 1970 and average economic growth rate in the subsequent 30 years for 120 countries. Source: Authors' calculations.

That education is an underlying force, mainly as a driver of economic growth and technological change, is recognized more and more in climate change modeling. A good example of this is SEDIM (Simple Economic Demographic Interaction Model) at IIASA (Sanderson 2004).

Conclusion

Human capital is often a serious constraint for development because there are not enough educated people of working age. But there is no theoretical limit to educating people. Therefore, it is a renewable and even expandable resource. There is no limit to how educated and wise people can get. It only takes some effort and some time to increase the level of education in a population, but it produces multiple benefits, from economic growth (see above) to better health (which is particularly important in the context of population ageing). There are two main policy implications resulting from our work: The first, that because there is a long time lag between investments in education and translation into levels of educational attainment, governments and development agencies should not wait to invest in education. Second, development goals should be extended to include secondary education.

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