Education and Economic Growth

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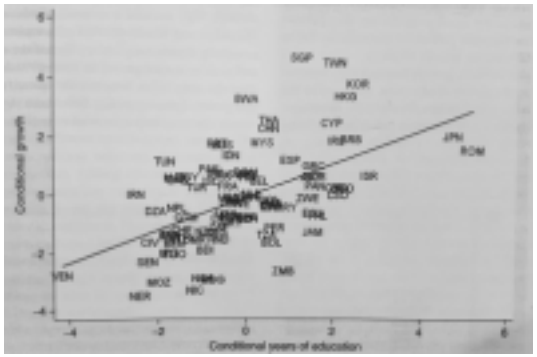
The theoretical growth literature emphasizes at least three mechanisms through which education may affect economic growth

- Education can increase the human capital inherent in the labor force, which increases labor productivity and thus transitional growth toward a higher equilibrium level of output
- Education can increase the innovative capacity of the economy, and the new knowledge on new technologies, products, and processes promotes growth
- Education can facilitate the diffusion and transmission of knowledge needed to understand and process new information and to successfully implement new technologies devised by others, which again promotes economic growth

Association between years of schooling and long-run economic growth

- Added variable plot of a regression of the average annual rate of growth in percent of real GDP per capita in 1960-2000 on average years of schooling in 1960 and the initial level of real GDP per capita in 1960
- Figure 1 provides a basic representation of the association between years of schooling and economic growth on the most recent version of available data
- This research suggests that each year of schooling is associated with long-run growth that is 0.58 percentage point higher
- Using average years of schooling as an education measure implicitly assumes that a year of schooling delivers the same increase in knowledge and skills regardless of the education system
- This measure also assumes that formal schooling is the primary source of education and that variations in the quality of nonschool factors affecting learning have a negligible effect on education outcomes
- This neglect of cross-country differences in the quality of education is the major drawback of such a quantitative measure

Figure 1: Association between years of schooling and long-run economic growth



The Quality of Education and Economic Growth

- Since the mid 1960, international agencies, such as the International Association for the Evaluation of Educational Achievement (IEA) and the Organization for Economic Co-operation and Development (OECD), have conducted many international tests such as the Trends in International Mathematics and Science Study (TIMSS), the Programme for International Student Assessment (PISA), and their predecessors – of student performance in cognitive skills mathematics, involving science, and other subjects
- A total of 36 international tests from 12 testing occasions comparable, Hanushek and Woessmann (2009) develop a common metric to adjust both the level of test performance and its variation through two data transformation
  - First, each of the separate international tests is benchmarked to a comparable level by calibrating the US international performance over time to the external standard of the available US longitudinal test (the National Assessment of Educational Progress, NAEP)
  - Second, the dispersion of the tests is standardized by holding the score variance constant within a group of 13 OECD countries with relatively stable secondary school attendance rates over time

Performance on international student achievement tests

- Simple average of the mathematics and science scores over all available international tests, using the rescaled data by Hanushek and Woessmann (2009) that puts performance at different international tests on a common scale
- Average performance at the standardized tests, which serves as a proxy for the quality of education
- The variation in the quality of education that exists among OECD countries is already substantial, but the difference from developing countries in the average amount of learning acquired after a given amount of schooling dwarfs any within-OECD difference
- Outside of East Asia, nearly every developing country that participated in one of the tests performed dramatically lower than any OECD country (except Mexico)

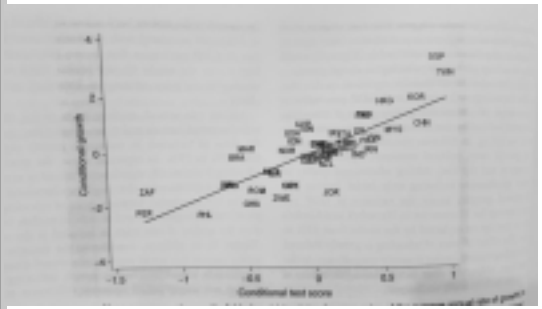
Figure 2: Performance on international student achievement tests

- Hanushek and Kimko (2000) find a statistically an economically significant positive effect of the quality of education on economic growth in 1960-1990 that is far larger than the association between the quantity of schooling and growth
- Ignoring quality differences very significantly misses the true importance of education for economic growth
- Their estimate suggest that one country-level standard deviation higher test performance (equivalent to 47 test score points on the scale used in (Figure 2) would yield about one percentage point higher annual growth
- In sum, the evidence suggests that the quality of education, measured by the knowledge that students gain as depicted in tests of cognitive skills, is substantially more important for economic growth than the mere quantity of schooling

The importance of cognitive skills for economic growth

- The measure of the quality of education is a simple average of the mathematics and science scores over international tests, interpreted as a proxy for the average education performance of the whole labor force.
- This measure encompasses overall cognitive skills, not just those developed in schools
- After controlling for the initial level of GDP per capita and for years of schooling, the test score measure features a statistically significant effect on the growth of real GDP per capita in 1960-2000 (Figure 3)
- According to this simple specification, test scores that are larger by 1 SD (measured at the student level across all OECD countries in PISA) are associated with an average annual growth rate in GDP per capita that is two percentage points higher over the whole 40 year period which is almost identical to the prior estimates in Hanushek and Kimko (2000)

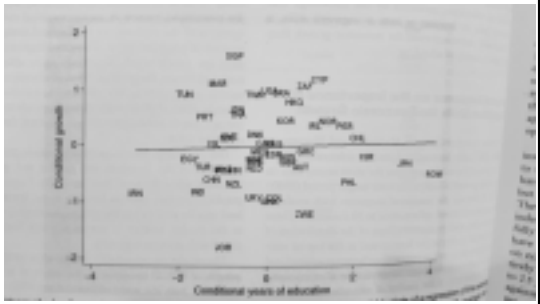
Figure 3:
Test-scores and Long-run economic growth



Years of schooling and economic growth after controlling for test scores

- Adding educational quality to a model that just includes initial income and years of schooling increases the share of variation in economic growth explained from 25% to 73%
- As reported above, the quantity of schooling is statistically significantly related to economic growth in a specification that neglects educational quality, but the association between years of schooling and growth turns insignificant and is reduced to close to zero once the quality of education is included in the model (Figure 4)
- In addition, considering the variation just within each of five world regions, educational quality is significantly related to economic growth, indicating that it does not simple reflect economic differences across regions

Figure 4:
Years of schooling and economic growth after controlling for test scores



The interaction of educational quality with economic institutions

- Economic institutions appear to interact with the effect of educational quality on economic growth
- The institution framework of a country affects the relative profitability of piracy and productivity activity
- If the available knowledge and skills are used in the former activity rather than the latter, the effect on economic growth may be very different, perhaps even turning negative (North, 1990)
- The allocation of talent between rent-seeking and entrepreneurship matters for growth: countries with more engineering students grow faster and countries with more law students grow more slowly (Murphy et al., 1991)
- Education may not have much impact in less-developed countries that lack other facilitating factors such as functioning institutions for markets and legal systems (Easterly, 2001)

- Due to deficiencies in the institutional environment, cognitive skills might be applied to socially unproductive activities in many developing countries (Pritchett, 2001)
- Adding the interaction of educational quality and one institutional measure – openness to international trade – to the growth specification indicates not only that both have significant individual effects on economic growth but also that there is a significant positive interaction
- The effect of educational quality on economic growth is indeed significantly higher in countries that have been fully open to interactional trade than in countries have been fully closed
- The effect of educational quality on economic growth is significantly positive, albeit relatively low at 0.9 per SD in closed economies but increases to 2.5 per SD in open economies
- When using protection against expropriation rather than openness to trade as the measure of institutional quality, there is similarly a positive interaction term with educational quality, although it lacks statistical significance

- In sum, both the quality of the institutional environment and the quality of education seem important for economic development
- The effect of educational quality on growth seems significantly larger in countries with a productive institutional framework, so that good institutional quality and good educational quality can reinforce each other
- The macroeconomic effect of education depends on other complementary growth-enhancing policies and institutions
- However, cognitive skills have a significant positive growth effect even in countries with a poor institutional environment

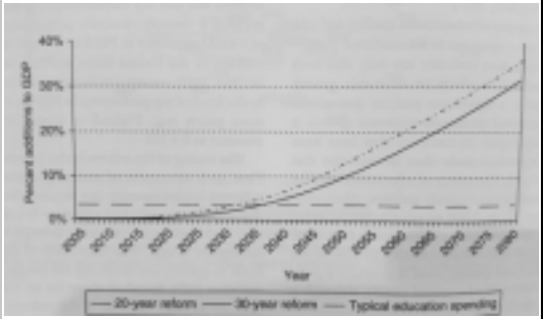
Simulating the impact of educational reform on economic growth

- For a better understanding of the impact of improved achievement, it is useful to relate policy reforms directly to the pattern of economic outcomes consistent with feasible improvements
- The timing of the reform is important in two ways
  - First, such a movement of student performance cannot be achieved instantaneously but requires changes in schools that will be accomplished over time (say, through systematic replacement of teachers through retirement and subsequent hiring). The time frame of any reform is difficult to specify, but achieving the change of 0.5 SD described above for an entire nation may take 20-30 years
  - Second, if the reforms succeed, their impact on the economy will not be immediate –initially the new graduates will be a small part of the labor force. It will be some time after the reform of the schools before the impact on the economy is realized. In other words, the prior estimates are best thought of as the long-run, or equilibrium, outcomes of a labor force with a given educational quality

Simulation of the impact on GDP of moderately strong knowledge improvement

- Faster reforms will have larger impacts on the economy, simply because the better workers become a dominant part of the workforce sooner (Figure 5)
- Simulation of the impact on the economy of reform policies beginning in 2005 and taking 20 or 30 years for a 0.5 SD improvement in student outcomes at the end of upper secondary schooling
- The figure indicates how much larger the level of GDP is at any point after the reform policy is begun as compared to that with no reform; that is, the estimates suggest that increase in GDP expected over and above any growth from other factors
- The figure also plots 3.5% of GDP, an aggressive spending level for education in many countries of the world
- Even a 30-year reform program would yield a growth dividend covering the whole of this spending level by 2036 (See Hanushek and Woessmann (2008))

Figure 5: Simulation of the impact on GDP of moderately strong knowledge improvement



- This simulation shows that the previous estimates of the effects of education quality on growth have large impacts on national economies
- At the same time, while the rewards are large, they also imply that policies must be considered across long periods, requiring patience – patience that is not always clear in national policymaking
- These reforms must also be put in a broader perspective because other kinds of institutional changes and investments will also take time
- Changing basic economic institutions seldom happens overnights and the economy needs time to adjust

Source

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Hanushek, E.A. and Woessmann, L. (2008). The role of cognitive skills in economic development. *Journal of Economic Literature*, 46(3), 607-668.

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