

Education and Growth

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The idea that education causes growth is popular. Every day, someone proclaims that countries must educate their citizens if they are to grow. Actually, this idea is not strongly supported by evidence. This is not to say that idea is false but rather, that it is difficult to determine rigorously whether education causes growth or whether growth causes education.

Although the evidence is not definitive, the economic logic is unambiguous for highly developed countries. As a matter of *logic*, they must educate their citizens well if they are to grow. Moreover, economic logic generates special insights.

I first review the evidence on the relationship between education and growth with a focus on the plausibly causal evidence produced by Philippe Aghion and myself. We focus on how education affects growth in highly developed countries. Next, I argue that even if the evidence is incomplete, economic logic strongly supports the idea that education is crucial to growth in highly developed countries. I derive three insights. Highly developed countries must have very *efficient* education sectors. Second, a country can fail to produce education efficiently by failing to allocate educational resources to students according to their potential. There is evidence that suggests that, at least in the U.S. and the U.K., very able students from low-income families fail to take full advantage of the educational opportunities open to them. Third, because it is *advanced* education that highly developed countries must produce efficiently, their universities must be governed and funded in a way consistent with producing innovation.

Despite the enormous interest in the relationship between education and growth, the evidence that education *causes* growth is fragile. This is because states that are faster growing tend to increase spending on education. Thus, some of the correlation between education and growth is reverse causality. For instance, China and India have recently grown greatly and have also increased their spending on education. But, it would be foolish to argue that their increase in education *caused* their economic growth. Rather, they reduced barriers to trade and constraints on production. Because their economies grew, their people are demanding more education and their governments are able to supply more schools.

Examples like China and India suggest that economic growth causes education, but does education cause growth? In recent work, Philippe Aghion and I test whether it does. To obtain causal evidence, we study "shocks" to states' education investments: occasions on which education spending suddenly grew for reasons unrelated to the economy. We study shocks that occur when a politician is assigned to a budgetary position that allows him to direct large expenditures to universities in the region from which he comes. So long as he remains in the position, his local universities receive greatly increased funding. When he leaves the position, the local universities return to normal funding. The typical funding shock lasts between 6 and 10 years.

We find that education funding shocks cause people to obtain more university degrees and that the shocks cause economic growth. However, these causal effects are much greater in highly developed

economies that contain industries that are driven by knowledge and technological innovation: software, finance, pharmaceutical invention, precision manufacturing, entertainment, etc. This suggests that the causal channel is advanced education fostering innovation, making capital and labor more productive, and thereby raising growth. (While there is little or no evidence that shocks to *university* education cause economic growth in developing countries, there is some evidence that shocks to primary education do.)

In fact, I find the evidence much less compelling than the economic logic. Logically, if highly developed countries are to grow, they must be increasingly productive in the industries in which they have a comparative advantage. However, highly developed countries have virtually no choice about their source of comparative advantage: it must be *human capital*. Our countries cannot hope to have comparative advantage in unskilled labor: many other countries have a greater abundance of it. Our countries cannot hope to have comparative advantage in raw materials and resources. Not only do other countries have abundant raw resources: they are usually willing to exploit them more efficiently, albeit with greater harm to their environments and the health of their people. We cannot plausibly hope to have comparative advantage in producing simple physical capital like factory equipment that can easily be replicated by people with only a secondary or lower tertiary education. We must largely rely on industries that are intensive in human capital.

Developed countries' reliance on comparative advantage in skill-oriented industries means that their education sector is their one indispensable upstream industry. By definition, an upstream industry produces inputs to other industries. People often fail to think of education as an upstream industry, but for highly developed countries, it is the crucial industry that produces the factor (human capital) that the countries must have in abundance if they are to grow where the areas where they could have comparative advantage.

From this economic logic, I derive three insights. First, human capital is made, not naturally endowed like--say--oil or fertile land. Therefore, it can only be relatively abundant in countries where the education sector is highly productive. That is, highly developed countries can only maintain comparative advantage in human capital by having schools that *efficiently* transform inputs into skills. It is not good enough that highly developed countries fund schools generously. Their schools must be efficient producers of education. This does not mean that their schools must produce only basic education. Quite the opposite. Their schools must produce advanced education *efficiently*.

This simple insight is often overlooked. Many people believe that generous education funding is sufficient. It may be necessary, but it is not sufficient. At least some people believe that it is acceptable for the education sector to be relaxed: a destination for those who do not want to work hard or who are not productive enough for private firms. This is incorrect. If a highly developed country wants to grow, it must insist that schools be highly productive.

The second insight is that a country's education sector will suffer from low productivity if *all* of its students with high potential are not identified. Every time a child with high potential for education fails to become highly skilled, a country is neglecting a valuable investment opportunity or, put another way, discarding valuable inputs. This alone makes the education sector inefficient. If two

countries have equally good schools but one fails to educate half of its students to their full potential, the latter's education sector is much less efficient.

One might think that no country would fail to educate talented students to their full potential, but the evidence suggests otherwise. My recent research has established that fully 88 percent of highly ability students from low-income families fail to attend one of America's top universities. This is despite the fact that these universities cost them much less than the lower resource tertiary schools they usually attend. My research demonstrates that low-income high achievers thrive when they are induced to attend the best American universities. Yet, the U.S. discards the vast majority of these investment opportunities and related research suggests that a similar phenomenon occurs in the U.K. In fact, I would be surprised if the same phenomenon did not occur in many highly developed countries. It is not enough for a country to *offer* students great educational opportunities. Some able students are unlikely to take them up unless someone gives them the roadmap. In a large randomized controlled trial, Sarah Turner and I demonstrate that customized information about educational opportunities can *dramatically* raise low-income high achievers' attendance at top American universities.

The third and final insight is that advanced education that produces innovation is inherently hard to predict. Thus, a government that centrally sets the curriculum and controls the research agenda of its universities will make them behind-the-times and less productive. Under such circumstances, economic logic suggests that universities should be flexible, autonomous organizations made to compete with one another for resources and prizes. Such systems are normal in innovative industries where firms compete for venture capital and patents. The same autonomy, flexibility, and competition that enable firms to innovate can characterize universities. But it often does not, and Aghion, Mathias Dewatripoint, Andreu Mas-Colell, André Sapir, and I exploit the variation among universities to produce evidence. We show that universities produce more innovation and more influential research when they have autonomy (to hire faculty, set salaries, select students) and when they must compete for resources. This is not to say autonomy and competition are sufficient: resources are necessary too. However, generously funding universities is not enough: they must be enabled to make productive use of those funds.

Education –especially advanced education– is likely crucial for highly developed countries' economic growth. But, funding schools generously is not enough. The education sector must be efficient. This means that students must be educated to their full potential. No talented student should be lost simply because he comes from a poor background. It also means that universities must have the autonomy to use funds productively and must have the incentives to do so.