The Value of Education: Evidence from Around the Globe

Robert E. Hall

In the United States education is a worthwhile investment. College graduates earn substantially more than high-school graduates, who earn more in turn than dropouts. Figure 1 shows recent U.S. data on annual earnings by education. It is worth almost $18,000 per year over what the holder of a B.A. earns to hold a graduate or professional degree. The college graduate earns, on the average, about $20,000 annually more than a high school graduate, and the benefit to graduating from high school rather than dropping out is about $8,000 per year in earnings. These figures understate the true differentials because they do not include the extra fringe benefits that go with higher earnings.

What about the rest of the world? Does education raise personal earnings in other industrial countries? In mid-level developing countries such as Turkey or Brazil? In the Third World countries of Africa and south Asia? Research has shown a strong relation between education and earnings in virtually every country studied. The percentage increase in earnings from an additional year of education is higher in countries with lower general levels of education. A recent survey shows that the additional year adds 13.4 percent to earnings in sub-Sahara Africa, 10.1 percent in

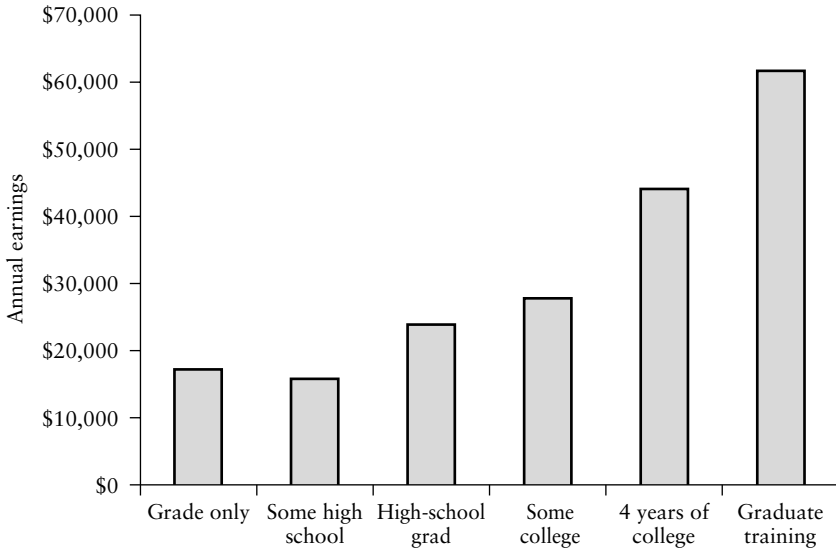

FIGURE 1. Annual Earnings of U.S. Workers by Education, 1998

(SOURCE: U.S. Bureau of the Census, Current Population Survey)

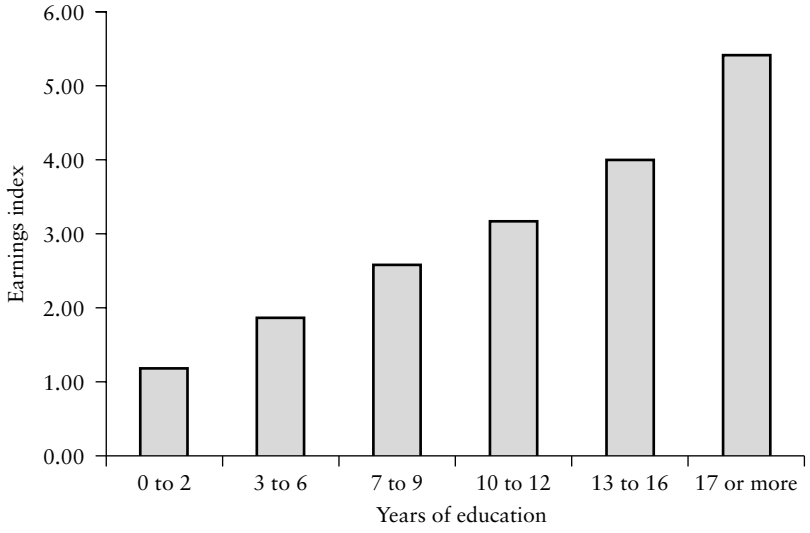

FIGURE 2. How Education Contributes to an Individual's Earnings (Based on Worldwide Data)

(SOURCE: Robert E. Hall and Charles I. Jones, "Why Do Some Countries Produce So Much More Output per Worker Than Others?" *Quarterly Journal of Economics* 114 [February 1999]: 83–116.)

the average country, and 6.8 percent in the well-educated countries making up the Organization for Economic Co-operation and Development (OECD) (United States, Japan, and Western Europe).[1] Figure 2 shows the relationship in a format similar to Figure 1. The figure shows an index of earnings by education level. The levels on the horizontal axis include categories not shown for the United States, where very few workers have less than a high school education.

The data show conclusively that education matters for the individual. A young person enjoys a substantially higher lifetime income for a few years' investment in education, even in countries where conditions seem unfavorable and the quality of education is generally low.

Some observers are concerned that education may pay off to the individual but not to the nation. For example, college graduates in Third World countries may find employment mainly in government bureaucracies. To deal with that issue, researchers have considered the relation between national average levels of education and productivity. This research has found a strong favorable effect of education.

A good measure of productivity for this purpose is output per worker. A team at the University of Pennsylvania has developed good measures of output for most of the countries of the world.[2] In principle, the data reflect physical measures of output, such as tons of steel or numbers of cars. They are intended to be insulated from distortions associated with exchange rate movements in particular. My own research in collaboration with Charles Jones makes one further adjustment with the data.[3] Some countries, notably oil producers, have high levels of recorded output because they extract natural resources from the ground. To remove this influence, which has little to do with the productivity of workers, we deducted the part of output arising in the mining and petroleum extraction industries. The data refer to the year 1988, before the collapse of the Soviet Union and the reunification of Germany.

Output per worker varies tremendously among the countries of the world, as Figure 3 illustrates. Down the left are

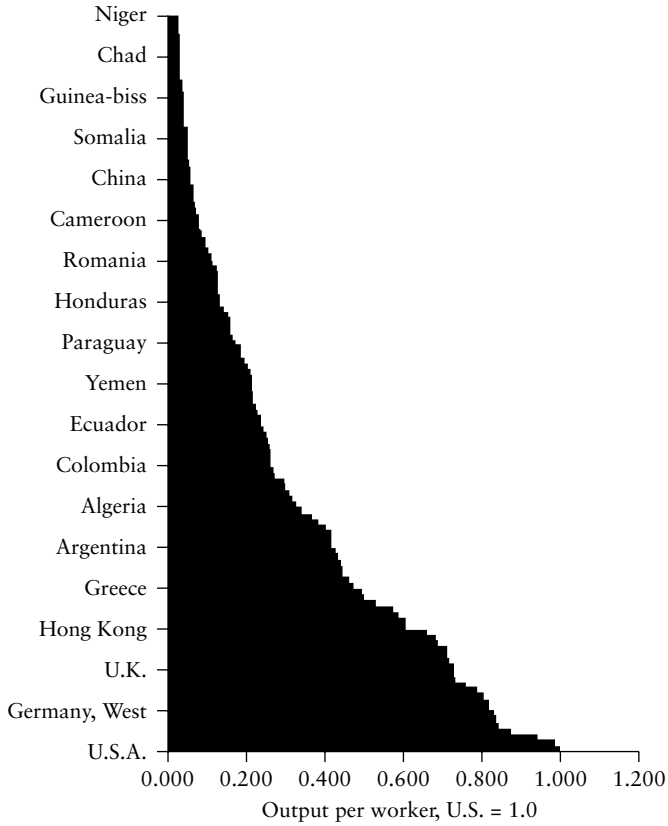

FIGURE 3. Output per Worker in 127 Countries
(SOURCE: See Figure 2)

examples of countries at each level of output per worker, moving downward in the figure in increasing order. The horizontal position of the gray area measures the output per worker of countries at that level in relation to the United States, the country with the highest output per worker. The countries at the top produce less than one-fortieth the level of the United States.

Jones and I calculated an index of education per worker by taking data on the educational attainment of the population of each country and applying the relative productivity factors from Figure 2. For example, our measure for a hypothetical country where everybody finished college would be about five

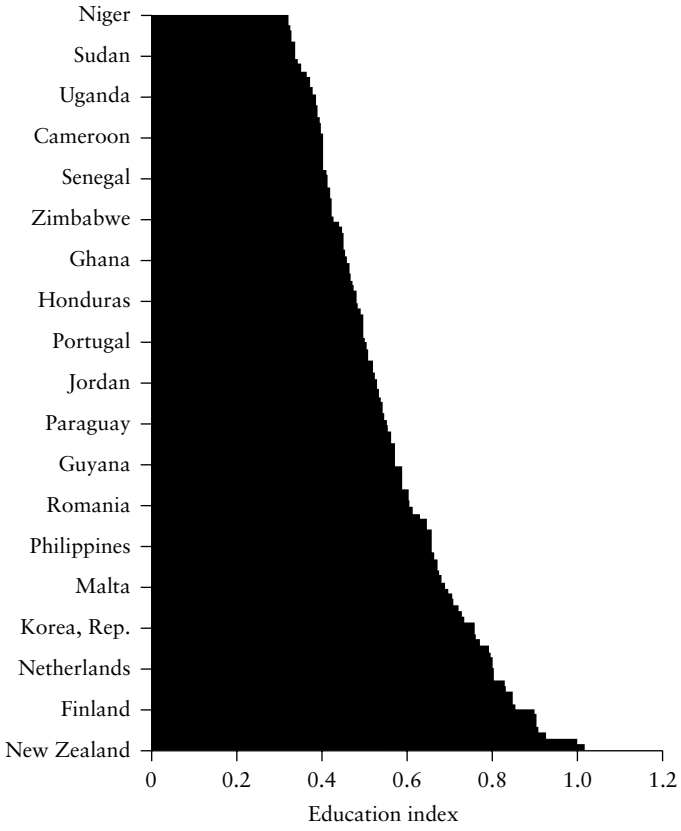

FIGURE 4. Education Index in 127 Countries
(SOURCE: See Figure 2)

times higher than the measure for a country where everybody attended only first grade. Our measure is appropriate if the differences in earnings do correspond to differences in actual productivity. We stated our index in relation to the U.S. level of education-related productivity. Figure 4 shows the variation among countries in their education indexes in the same format as Figure 3.

There is nowhere near as much variation in education across countries as there is variation in output per worker. I will shortly discuss the other factors that account for low output per worker in countries such as Niger, where the education

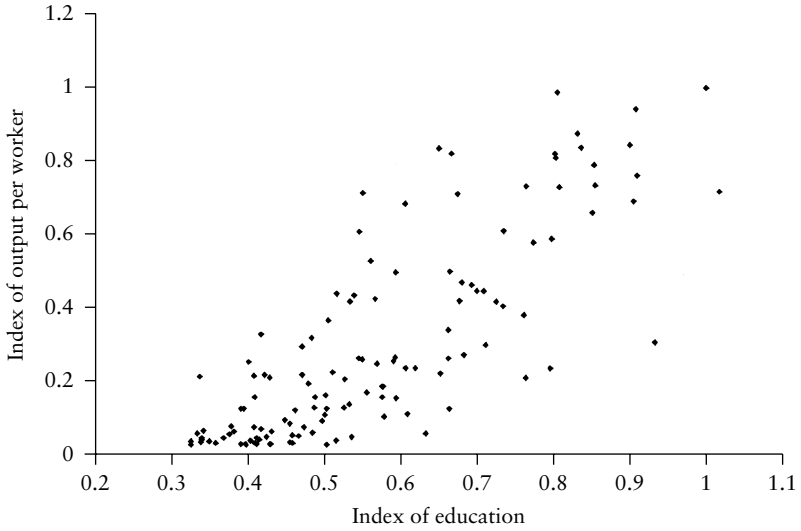

FIGURE 5. The Relation Between Education and Output per Worker Across Countries

(SOURCE: See Figure 2)

index is about 40 percent of the U.S. level, but output per worker is less than 2.5 percent of the U.S. level.

The education index correlates substantially with output per worker, as Figure 5 shows. The diamonds mark the value of the education index by the horizontal position, and output per worker by the vertical position. Those at the lower left denote the low-output, low-education countries at the tops of Figures 3 and 4. Those at the upper right are the high-output, high-education countries. Some countries depart from the general pattern. For example, Hungary has an education index not far below the very top countries, but its low output per worker is comparable to countries with much less education, such as Brazil and Iran. Hungary and other then-Soviet-bloc countries tended to have low levels of output given their resources.

Figure 5 provides powerful support for the idea that education makes a genuine contribution to productivity and is not just a credential that raises individuals' earnings. Raising

the general level of education is almost certainly an appropriate top priority for a country aiming to raise its standard of living. But other factors matter for output per worker. One is the amount of plant and equipment available to combine with workers' efforts to produce goods and services. My research with Jones developed a measure of plant and equipment stocks for the countries reported in the previous figures. A second determinant of output per worker is the efficiency of the economy in production. Some countries are more effective in organizing production and are able to achieve higher levels of output from the same amounts of capital, labor, and education as other countries. Jones and I also calculated efficiency indexes for the countries in our sample. We do not have an independent measure of efficiency—we infer efficiency from data on output and inputs.

Table 1 reports the values of the indexes for selected representative countries. In all cases, the United States has the value 1.0—all of the numbers for other countries are stated as ratios to the U.S. level. Although the United States is close to the top in all three determinants—education, plant equipment, and efficiency—it does not rank first in any of them. New Zealand (not shown in Table 1) had slightly more education. The Soviet Union (in 1988) had substantially more plant and equipment in relation to output than did the United States. Italy is well ahead of the United States in terms of efficiency, along with France and Hong Kong. But the United States is sufficiently high in all three components to have the highest result from multiplying the three together, that is, the highest output per worker.

The three components shown in Table 1 are quite highly correlated—that is, countries at the top in education tend to be at the top in plant and equipment and in efficiency. My research with Jones explored the underlying determinants of the three components. We asked the question, what fundamental factor results in the accumulation of high levels of education, large stocks of plant and equipment, and in a high level of efficiency? Our answer focuses on social infrastructure. Some

TABLE 1. Data on Output per Worker and Its Three Determinants, for Selected Countries

		Contribution from		
Country	*Output per worker*	*Education*	*Plant and equipment*	*Efficiency*
United States	1.000	1.000	1.000	1.000
Canada	0.941	0.908	1.002	1.034
Italy	0.834	0.650	1.063	1.207
West Germany	0.818	0.802	1.118	0.912
France	0.818	0.666	1.091	1.126
United Kingdom	0.727	0.808	0.891	1.011
Hong Kong	0.608	0.735	0.741	1.115
Singapore	0.606	0.545	1.031	1.078
Japan	0.587	0.797	1.119	0.658
Mexico	0.433	0.538	0.868	0.926
Argentina	0.418	0.676	0.953	0.648
U.S.S.R.	0.417	0.724	1.231	0.468
India	0.086	0.454	0.709	0.267
China	0.060	0.632	0.891	0.106
Kenya	0.056	0.457	0.747	0.165
Zaire	0.033	0.408	0.499	0.160

(SOURCE: See Figure 2.)

countries have institutions that promote accumulation and efficiency. Where the social infrastructure is strong, businesses and workers concentrate on productive activities. They do not fear the loss of the fruits of their efforts to parasites. More than anything else, strong infrastructure means an effective rule of law.

Government provides most of the social infrastructure that promotes accumulation of human and physical capital and the achievement of high levels of efficiency. Government enforces laws against thievery, squatting, Mafia activities, and other crimes that divert output from those who create it.

Government enforces private contracts, a key part of the infrastructure. Government establishes effective property rights. But government may also contribute to diverting output through taxation, expropriation, and corruption. An effective government uses an efficient tax system with non-confiscatory tax rates. It avoids expropriating businesses and pays market value when it takes property from the public. Corruption is perhaps the most important threat. In countries with weak infrastructure, government officials use their positions to steal from productive people and businesses.

One of our findings is that the effectiveness of government is more important than the relative role of private and public economic activity. A government that largely suppresses corruption and other forms of government-sponsored diversion, but with a large involvement in the economy in the forms of government-operated businesses and aggressive tax-transfer programs, can still create an environment conducive to capital accumulation and productive efficiency. Sweden and France are good examples. Even the Soviet Union, where the government ran almost the whole economy, achieved levels of capital accumulation not too far behind the United States and a level of efficiency almost half that of the United States. By contrast, India and China, with much less effective governments, were one-fourth and one-tenth as efficient as the United States in 1988.

Jones and I calculated an index of social infrastructure from data on corruption, expropriation, law enforcement, and other dimensions of government effectiveness. Figure 6 displays the values of our index in the same format as earlier figures. The countries at the top, with index values at about one-third the of U.S. level, have high levels of corruption, poor enforcement of criminal and contract law, ineffective property rights, high rates of Mafia-type activities, and frequent government expropriation. The rewards for business activity in those countries are few. Capable people go into criminal and other parasitical activities rather than produce goods and services. The countries at the bottom have strictly

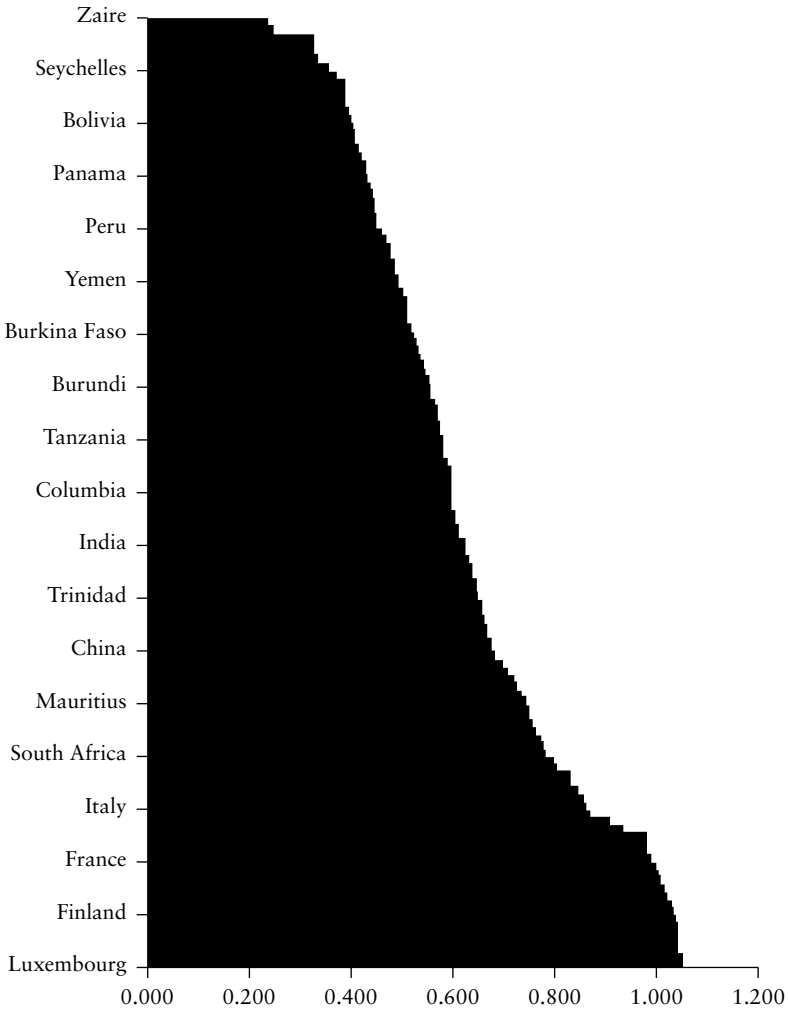

FIGURE 6. Index of Social Infrastructure, with United States at 1.0
(SOURCE: See Figure 2)

honest governments, effective courts for law enforcement with capable, honest judges, police forces that deter crime by aggressive pursuit of the small number of criminals, and governments that respect property rights and do not expropriate private economic gains. Although the United States scores high in these measures, it is not at the top. Most of the countries

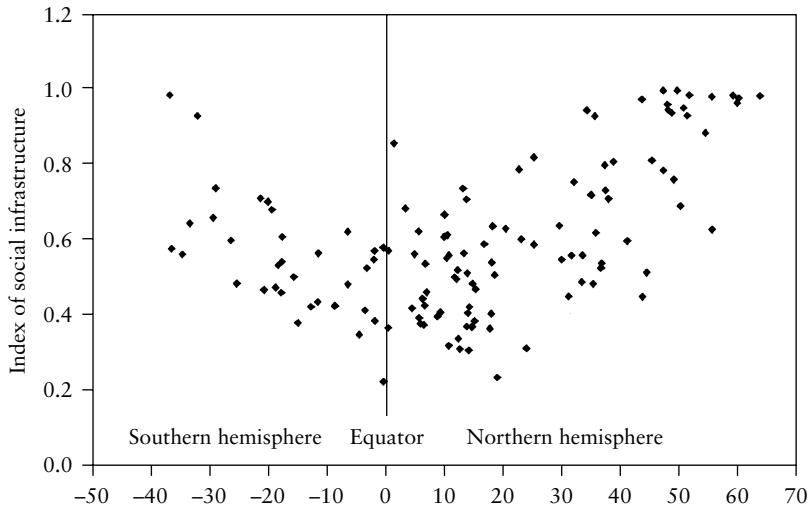

FIGURE 7. Education and Social Infrastructure
(SOURCE: See Figure 2)

in northwest Europe score somewhat higher, as does Canada.

Countries with strong social infrastructures foster accumulation of human capital. They send large numbers of children and young adults to private and public schools, colleges, and universities. Figure 7 shows the relationship in our set of countries between our index of infrastructure and our index of education. The countries in the upper right—mostly in Western Europe, North America, and east Asia—have capable, honest governments. In most of them, government is the primary provider of education. They have high stocks of human capital. The countries in the lower left have corrupt, ineffective governments. Neither the government nor private education function well. Workers are poorly educated and output per worker is low.

What factors lead a country to adopt an effective social infrastructure? We don't have a complete answer to this question, but history sheds some light. The principles of government that yield high scores in the measures that go into our index of infrastructure originated in Western Europe

in the years leading up to the late eighteenth century. The publication of Adam Smith's *Wealth of Nations* in 1776 marked the full development of the ideas, although their adoption took two more centuries. The principles spread over the globe unevenly. Colonialism was an important factor, but becoming a colony of a European power was no guarantee of later development of favorable infrastructure, as the cases of India and Bolivia demonstrate, with infrastructure indexes of about 0.6 and 0.4 respectively.

Recent thinking about the development of infrastructure emphasizes the importance of settlement in a colony.[4] Colonialism had two versions. In one—applicable to the United States, Canada, Australia, and to some extent Argentina—the colonial power conquered land thinly populated by nomads. Settlers brought institutions and infrastructure from the home country. In the United States, infrastructure soon outstripped England's, as the largely self-governing colonies developed more efficient and honest governments.

In the second version of colonialism, its dark side, the purpose of conquest was exploitation of an existing population. The home country sent administrators and soldiers, not settlers. The colonial power functioned as a diverter of value from existing economies. India is a leading example. Britain never introduced British government to India, nor did many of the British settle there. Rather, British policy was to make alliances with existing government units whose infrastructure was altogether different. The British in India governed by corrupting governments. The adverse effects of colonialism in Africa need no comment. Spanish and Portuguese colonial policies in Latin America were generally extractive rather than transplantive. Chile has succeeded in creating a reasonably favorable infrastructure, but equatorial Latin America still mainly has governments with low infrastructure scores.

The choice between the two colonial models was not by chance. Settlement occurred in the kind of temperate climates familiar to Europeans. The United States, Canada,

Australia, and New Zealand all offered healthy climates. They also lacked indigenous populations with systems of property rights recognized by the British. In their colonies, the law-abiding British respected existing systems of property rights resembling the British system, where property owners marked their land and generally lived on it. They rejected property claims of nomads.

Acemoglu and his co-authors point to the specific role of potential mortality as a prime determinant of the location of settlement. Mosquito-borne diseases—malaria and yellow fever—were the main cause of death of settlers in the tropics. Hence, settlers avoided low-latitude locations where mosquitoes lived year-round and thus could propagate disease. Settlement occurred at higher latitudes, whereas the extractive model, particularly in the cultivation of sugar, was adopted for low latitudes.

These patterns left a legacy plainly visible today. With the single very special exception of Singapore, countries near the equator have poor infrastructure, low levels of education and physical capital, and low efficiency. Figure 8 shows the countries that Jones and I studied, arrayed by location relative to the equator. There is an unmistakable U shape to the plot. Because the preponderance of the world's land area is north of the equator, most of the markers are to the right of the vertical line denoting the equator. In both hemispheres, the markers rise for latitudes away from the equator.

The marker just to the right of the equator line in Figure 8 and well above the others for equatorial countries is Singapore. This country validates the underlying ideas about infrastructure, even though it is a notable exception to the rule that tropical countries have poor infrastructure. Singapore was an uninhabited island claimed by the British in the early nineteenth century as a military base. British policy never attempted to extract value from the population that gradually developed, mostly Chinese but with a significant Malay minority. Rather, the British allowed the development of British institutions and infrastructure.

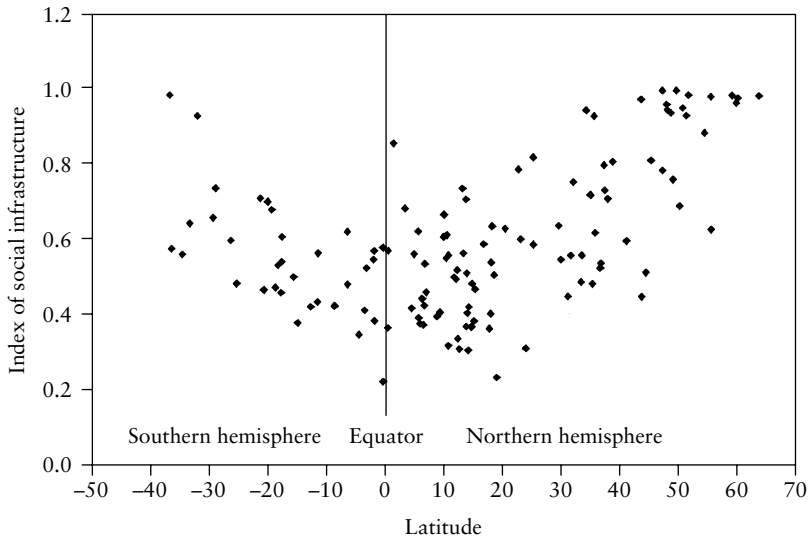

FIGURE 8. Location and Social Infrastructure
(SOURCE: See Figure 2)

The pattern of education over the globe tracks the pattern of infrastructure. Countries in higher latitudes, more likely to have strong infrastructure, accumulate more human capital. Figure 9 shows the U-shaped relation between our education index and latitude. Singapore is not a standout in education because such a large fraction of its population comprises recent immigrants from countries such as China with poor infrastructure and correspondingly little education.

CONCLUSIONS

Global evidence shows that education contributes to national productivity as well as to individual earnings. Countries with strong institutions and infrastructure, and effective governments, arrange to provide their citizens with substantial amounts of education, sometimes exceeding the U.S. level. Accumulation of human capital is one of the three important benefits that flow from good infrastructure; the others are

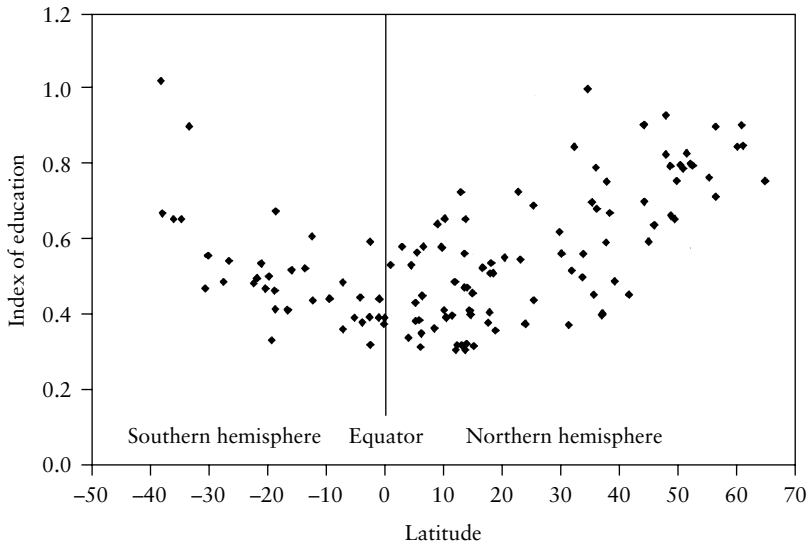

FIGURE 9. Location and Education
(SOURCE: See Figure 2)

accumulation of plant and equipment and the development of efficient production.

The countries of the world that have achieved high levels of education for the average person have done so in varying combinations of self-finance, government subsidy, and direct provision of education. One of the few favorable characteristics of the discredited socialist governments of Eastern Europe was the provision of high levels of education. As the relative cost of education continues to rise in relation to other goods and services, the strain to finance high levels of education will worsen.

NOTES

1. George Psacharopoulos, "Returns to Investment in Education: A Global Update," *World Development* 22 (1994):1325–43.
2. Robert Summers and Alan Heston, "The Penn World Table (Mark 5): An Expanded Set of International Comparison:1950–1988," *Quarterly Journal of Economics* 106(1991): 327–68. The data, updated, are available from http://pwt.econ.upenn.edu/.

3. Robert E. Hall and Charles I. Jones, "Why Do Some Countries Produce So Much More Output per Worker Than Others?" *Quarterly Journal of Economics* 114(February 1999): 83–116.
4. Daron Acemoglu, Simon Johnson, and James Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," NBER Working Paper no. 7771, June 2000.