A comparative analysis of education costs and outcomes: The United States vs. other OECD countries

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ABSTRACT

In this paper we confirm the universality of steadily rising education expenditures among OECD nations, as predicted by "Baumol and Bowen's cost disease", and show that this trajectory of costs can be expected to continue for the foreseeable future. However, we find that while the level of education costs in America is significantly higher than that of all other OECD countries, education spending per student in the United States is increasing about as quickly as it is in many other countries—perhaps even less quickly. Although these cost increases undoubtedly will contribute to each nation's fiscal problems, we conclude that effective education contributes to improvement of the economic performance of each country and can mitigate resulting financial pressures by spurring growth in overall purchasing power.

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1. Introduction

Education costs, very much like the expenses of health care, have grown unceasingly—not only in the United States but also throughout the world's more prosperous economies. This phenomenon, known to economists as the "cost disease," has introduced a number of urgent public policy problems—the most urgent and obvious of which is affordability. Amid these relentless spending increases, can governments, or individuals, hope to provide adequate funding for public education? The need for such funding is part of a virtuous cycle, in which education fuels the technical progress and growing productivity (via R&D and a more educated workforce) that, in turn, provide significant funding for education. Indeed, without education and with the resulting decline in innovation and education of the workforce, productivity growth can be expected to slow or cease altogether, just as the educational process will be handicapped—or perhaps harmed irrevocably—by inadequate funding.

America's education cost problem has been investigated extensively, notably in studies carried out under the leadership of William Bowen. Still, there is much more to be learned about this important topic. Notably, it is widely

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Bowen's newest book, Higher Education in the Digital Age (2013), is only the most recent of his many invaluable contributions in this area.
believed that education costs in the United States are higher and growing more rapidly than in other countries, and, therefore, our system is no longer viable. Equally misleading is the frequent claim that America’s educational system is the best in the world. In this report we show that the accuracy of such observations and their implications for policymaking are often quite different from what is frequently portrayed by politicians and journalists. Our reevaluations in a number of cases, but not all, cast a more favorable light on our country’s achievements in education. However, the true significance of this project lies primarily in offering analysis of reliable evidence that can provide some guidance for the future.

A number of our key observations in this report are not (yet) widely recognized. For example, we will show that education spending in the United States varies substantially by the level of education (primary and secondary education vs. higher education) and, moreover, differs from spending patterns in other wealthy nations (OECD, 2012a, p. 7). Moreover, we will see that while the level of education costs in America is significantly higher than that of all other OECD countries, America’s rate of growth in education spending, relative to these other countries, occupies a very different position. Our analysis shows that education spending per student in the United States is increasing about as quickly as it is in many other countries—perhaps even more slowly.

Aside from providing clarification of the facts of education funding and costs, our report offers suggestive observations about differences in procedures, orientation, and accomplishments in other countries’ education systems. We find that different countries excel, or have fallen behind, in different areas of education (e.g., teacher training, efficient allocation of resources, equity, etc.), and that the differences among the countries we examine offer valuable insights for understanding how to improve student learning and, thereby, enhance economic productivity and the general welfare.

Still, our primary focus is on the behavior of costs. In this arena, we confirm the universality of steadily rising education expenditures among OECD nations. We show that this trajectory of costs can be expected to continue for the foreseeable future. Although these increases undeniably will contribute to each nation’s fiscal problems, we argue that effective education contributes to improving a nation’s economic performance. Hanushek and Woessmann (2008, 2012) argue that the cognitive skills of a country’s population play an important role in economic growth, with high quality schools necessary to nurture these skills (Hanushek, 2013). Similarly, we contend that a strong, fully funded education system spurs growth in overall purchasing power, thereby mitigating the financial pressures associated with funding of education. Moreover, we discuss some developments in education—notably, the increasing role of technology—that may mitigate these fiscal problems afflicting education, perhaps substantially. Some of these innovative approaches to enhancement of productivity in education not only constrain fiscal pressures, but also promise to enhance the quality of education provided to students. But are such solutions enough to alleviate—or even cure—the cost disease?

2. Context: What is the “cost disease” and can it be alleviated?

2.1. Symptoms of the disease

Those of us who have children or grandchildren attending universities are only too painfully aware that education is beset by dramatically rising costs, which are now eliciting growing political attention. Indeed, the National Center for Public Policy and Higher Education reports that nearly two-thirds of Americans “believe that college prices are rising faster than the cost of other items” (Immerwahr & Johnson, 2009). Data from the Bureau of Labor Statistics, published in an earlier National Center for Public Policy and Higher Education report, confirms the accuracy of such perceptions (2008, p. 8, Fig. 5). Since the early 1980s, the price of college tuition in the United States has increased by a much greater percentage (+440 percent) than the average rate of inflation (+110 percent) and median family income (+150 percent).

At the primary and secondary school levels, data from the Organisation for Economic Cooperation and Development (OECD) indicate that during the last decade costs also have been rising persistently and, in many countries, dramatically (OECD, 2011a). In the United States, cities and states, encumbered with steadily rising debts, have been driven to seek desperate means to move toward fiscal solvency, by reducing spending on teacher salaries, school facilities, and the other inputs to the educational process. Such cuts clearly pose a major threat to the future economy of the United States.

In recent decades, the average U.S. consumer’s expenditures on college tuition and fees have risen steadily at rates markedly outstripping inflation. According to the U.S. Bureau of Labor Statistics, college tuition and fees increased at a rate of just over seven percent per year during the last 30 years. Measured in dollars of constant purchasing power, college tuition increased by more than 250 percent during that period. Indeed, when we compare educational costs with health care costs, we find that cost increases for both show very similar patterns. That is just what the cost disease analysis would lead us to expect, as the productivity of both activities cannot be enhanced, while maintaining quality, by putting them on an assembly line or substituting robots for teachers or physicians. In both cases, government is left with the understandably unpopular task of obtaining the requisite funding for these two services.

The steadily growing real costs of education are hardly an issue peculiar to the United States. In fact, there are few industrialized countries in the world in which similar complaints about rates of cost increases are not heard. (Our analysis of education spending by OECD countries in

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4 Hanushek and Woessmann persuasively contend that cognitive skills (as measured by scores on international assessments) are related to economic growth, but Heckman, Storzrud, and Urzua (2006) find that both cognitive and non-cognitive attributes—such as, self-regulation, motivation, time preference, far-sightedness, and adventurousness—contribute to an individual’s economic and social success.
Section 4 confirms these anecdotal accounts.) The explanation for a key part of the problem is that labor-saving productivity growth is going forward throughout the economy. However, there are some activities where the quality of the product is closely intertwined with the quantity and intensity of human effort devoted to that task. The resulting impediment to labor-saving changes in these activities condemns the costs of those effort-intensive services to keep rising year after year, in comparison with the many products of the economy whose growing automation means that expenditures on wages decline significantly year after year. For instance, we simply cannot automate the teaching process without losing much of its value. Similarly, if we constantly increase labor productivity in education by making class sizes larger and larger, so that the number of students handled by one instructor increases steadily, then the quality of that education is likely to decrease.

The pain society experiences from the rapidly rising costs of education does not derive primarily from the levels of these costs at some particular date but, rather, from their growth rates. What makes the problem so difficult to deal with is the fact that, as high as health care and education costs may have been yesterday, they are considerably higher today, and will be substantially higher tomorrow. Indeed, the magnitude and persistence of the rates of growth of these real prices are sufficiently striking as to leave little doubt that even if the rates of increase of the real costs of education are not the only difficulty, they are surely a major component of the problem of rising costs of government operation.

Why are the costs of education and other effort-intensive services rising so persistently at rates faster than the economy’s rate of inflation? What has come to be called the “cost disease” is the common influence underlying rising costs (and other related problems, such as some forms of deteriorating service quality—e.g., the rarity of household visits by doctors or declining hospital cleanliness) in education, health care, and other service industries. The disease afflicts both the private and public sectors—no matter how uncorrupted an organization’s conduct or how efficient its employees. The resulting cost increases can be expected to continue to grow, with little prospect of abatement, for reasons that will be explained next.

First, however, we must emphasize that in addition to the cost disease, there are many factors that contribute to the high costs of health care, education, and other labor-intensive services. But while such factors may contribute much to the high level of expenditures associated with these services, none of them can explain adequately the rapid and seemingly inexorable rate of increase in the costs of these services. Thus, for the purposes of this research, we focus on the role of the cost disease as a critical element in the explanation of these cost increases.

2.2. How the cost disease works

The cost disease can best be explained using an analogy: In 1946, a deploring U.K. newspaper headline sought to shock readers by reporting that “Nearly Half of U.K. Student Grades Are Below Average.” The cost disease functions the same way. To see this, we must remember that any index of the overall price level, which serves as the measure of the economy’s rate of inflation, is just an average of the prices in the economy. It follows that if the prices of all commodities are not rising at the same pace, then some must be increasing at a rate above average (i.e., their relative costs and inflation-adjusted—or real—prices must be rising), while others must be characterized by real prices that are falling. Education is one of the outputs whose price is rising at a rate above average, for reasons we already have noted. This means that, by definition, education costs must be rising faster than the economy’s overall (average) rate of inflation.

The only additional component of the cost disease is the observation that the list of those products and services whose real prices are rising remains roughly unchanging, decade after decade. That is, the cost of education is rising faster than the average rate of inflation today, and we can be reasonably confident that it will continue to do so tomorrow, as well as the day after that, while the opposite will be true of automobile manufacturing, where costs continually fall behind the economy’s average inflation. The reason is not difficult to identify. The items in the rising-cost group generally have a handicraft element—that is, a human element not readily replaceable by machines in their production process, which makes it difficult to reduce their labor content. In contrast, items in the other group are predominantly manufactured via much more easily automated processes. As such, their steadily falling real prices are simply the reflection of their continually declining labor content.

This idea is fundamentally simple. The growth rate of costs in some of the economy’s industries must be below the average, while others must be above it. The former group is composed substantially of industries in which the nature of the production process offers few opportunities for labor-saving changes, while the latter, the industries with relatively falling prices, are those where the opportunities for labor-saving changes are abundant.

The clue to a fuller explanation lies in the nature of the products whose real prices are driven upward by the cost disease. The cost disease stems from the basic nature of what we call the “personal” services, whose quality usually requires direct, face-to-face interaction between those who provide the service and those who consume it. Teachers, doctors, and librarians all engage in activities that require in-person contact.

In other parts of the economy—car manufacturing, for instance—no direct personal contact between the consumer and the producer is required. Thus, the buyer of an automobile usually has no idea who worked on its assembly and does not care how much labor time went into its production. Moreover, when a new labor-saving production process that allows an auto plant to increase its annual production by, say, 25 percent without increasing its workforce is introduced, it follows that the rise in output will exactly offset the cost of the higher wages if the size of the labor force is left unchanged but wages are
increased by 25 percent. In contrast, a reduction in the amount of time put into a personal service is likely to reduce its quality. In other words, an increase in labor productivity in education—that is, a rise in production per labor hour (the number of students educated in a given amount of time)—is difficult to attain without an accompanying decline in quality.

As a result, over the years it has proved far easier for technological change to save labor in manufacturing than it has in providing many of the economy’s services. In the post–World War II period, for instance, productivity in the United States’ (nonfarm) business sector grew by roughly two percent on average per year (Bureau of Labor Statistics, 1947–2008). Meanwhile, measured this way, labor productivity in elementary and secondary education, for example, actually declined, with the average number of pupils per teacher in public schools falling from about 25 pupils per teacher in 1960–1961 to about 15 pupils per teacher in 2006–2007 (Snyder, Dillow, & Hoffman, 2009, p. 57, Fig. 6).

It should be clear how such differing productivity growth rates lead to rising real prices in some industries and relatively declining real prices in others, as growing productivity raises wages throughout the economy. Take, for example, manufacturing—if wages in this sector rise by 2 percent, the cost of manufactured products need not rise because increased output per worker offsets the higher wages. In contrast, the nature of many services makes it very difficult to introduce labor-saving devices. A 2 percent wage increase for teachers or police officers, for instance, is not offset by higher productivity and must lead to equivalent increases in municipal budgets.

In the long run, wages for all workers throughout the economy tend to go up and down together. Otherwise, an activity whose wage rate falls seriously behind will tend to lose its labor force. Auto workers and teachers will see their wages rise at roughly the same rate in the long run, but if productivity on the assembly line advances, while productivity in the classroom does not, then the cost of education will increase ever more—relative to manufacturing. Because productivity improvements are very difficult to achieve for most personal services, their costs can be expected to rise more rapidly in the long term than the costs of manufactured products. Over a period of several decades, the two sectors’ differing cost growth rates add up, making personal services enormously more expensive than manufactured goods. This goes far to explain why these services have grown steadily more costly, compared to manufactured goods, and why this trend is very likely to continue.

There is, however, one exception to this pattern of behavior, which occurs when the economy is mired in recession. In such periods, wages cease their upward movement, even in industries that benefit from productivity growth. As a result, even with no reduction in the labor force, costs temporarily cease their upward movement in the industries affected by the cost disease. This caveat was noted as part of the original cost disease analysis, published almost half a century ago (Baumol & Bowen, 1966), and, since then, this pattern seems to have persisted.

2.3. Can the cost disease be cured?

In recent years, a variety of labor-saving innovations—most notably those connected with the computer and other hi-tech developments—have affected many industries, including education. However, the cost disease analysis takes as its premise the idea that while some valuable avenues for labor saving already have been employed in the educational process, none of these has resulted in steadily decreasing costs anywhere near what computer manufacturing has been able to achieve. Assuming no catastrophic developments undermine our economic system, we contend that these rising costs can be expected to endure for the foreseeable future.

3. International comparison results: analysis of education spending data for OECD nations

Our analysis of the education costs in OECD countries included in our study provides strong confirmation of the cost disease model. Thus, education everywhere can be expected to grow ever more expensive with the passage of time. That, in itself, is a result of some significance because it draws attention away from the search for misbehavior and inefficiency in education systems, which invariably are blamed for the rising costs of education.

We were prepared for some marked deviations in the performance of different countries because the cost disease is hardly the only influence that determines the magnitude of educational expenditures. However, our calculations lead us to the following key observations, which are in accord with the cost disease analysis:

- First, there is a negative correlation between the ratio of total educational expenditures to GDP and the level of labor productivity across OECD countries. That is, the more rapidly overall productivity increases in a particular country, the more slowly total education costs can be expected to grow relative to GDP. Similarly, there is a negative correlation between the ratio of total educational expenditures per student to GDP per capita and the level of labor productivity across OECD countries.
- Second there is a positive correlation between real educational expenditures per student and the level of labor productivity across OECD countries (see Fig. 1). That is, more spending on education leads to a more efficient and productive workforce.
- Third, the cost disease produces the same set of relations for the individual components of educational expenditures, including outlays on educational personnel alone, primary school alone, and secondary schools alone (see Figs. 2–6).

Specifically, our findings indicate that U.S. total educational spending, as a share of GDP, is about is 26 percent higher than the average of the other OECD countries—even after controlling for the effects of the ratio of the number of students to the total population and employment as a share of the population. In particular, the share of educational personnel compensation as a portion of GDP is approximately 30 percent higher than the OECD.
Fig. 1. Labor productivity and total educational expenditures per student in PPPS, 2006.

Fig. 2. Labor productivity and total current educational expenditures per student in PPPS, 2006.

Fig. 3. Labor productivity and compensation of educational personnel per student in PPPS, 2006.
average in the United States, while that of the ratios of non-personnel costs to GDP and capital expenditures to GDP in the United States are roughly 50 percent higher than the OECD average. Similarly, the share of higher education spending in U.S. GDP is 50 percent higher than the OECD average. In contrast, the share of primary-school spending in U.S. GDP is only about 15 percent higher than the OECD average, while secondary-school (i.e., high school) spending is just two percent higher than the OECD average.
Table 1
Average annual rates of growth in education spending (by level) and GDP per capita in OECD countries, 1998–2007.

<table>
<thead>
<tr>
<th>Country</th>
<th>Secondary school spending</th>
<th>Country</th>
<th>Primary school spending</th>
<th>Country</th>
<th>Tertiary school spending</th>
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Data for Canada at the primary and secondary levels are not included in this table because they were not available. No data were available for Switzerland, Turkey, Slovak Republic, Poland, Hungary, Greece, Belgium, New Zealand, and Luxembourg.

Secondary education made up the largest share of educational expenditures (40 percent), followed by primary education (30 percent) and tertiary education (25 percent). Among the countries in our study, the rates of growth at all three levels of education mostly fell within the range of 0–10 percent, with a few exceptions (U.K. primary school spending growth was about 9 percent, on average, each year, and Canada’s tertiary school spending growth was almost 11 percent, on average, each year). Interestingly, the range of growth rates at the tertiary level was particularly large—from a roughly two percent decline per year in Iceland to nearly 11 percent growth per year in Canada. In addition, if we consider the different components of educational expenditures in the OECD countries we studied—including compensation for educational personnel (70 percent), non-personnel costs (20 percent), and capital expenditures (10 percent)—we find that all three components increased as a share of GDP over the decade.

The most important finding of our analysis is that although the United States has the highest total educational expenditures per student, the average annual rate of increase in education spending in the United States is not even close to being the highest in the OECD. Table 2 ranks growth rates in education spending by country and level of education for the period between 1998 and 2007. Despite having the highest levels of education spending, the rates at which costs increased in the United States are well below average at both the primary and tertiary levels (see Table 2). At the secondary level, education costs in the

Table 2
Levels and growth rates of educational expenditures vs. GDP per capita in Finland, Korea, Norway, the U.S.

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<tr>
<td>Finland 6321</td>
<td>1.35 (%)</td>
<td>33,501</td>
<td>3.21% (1998–2007)</td>
</tr>
<tr>
<td>Korea 5356</td>
<td>7.01 (%)</td>
<td>25,021</td>
<td>5.11% (1998–2007)</td>
</tr>
<tr>
<td>Norway 10,161</td>
<td>0 (%)</td>
<td>49,102</td>
<td>1.86% (1998–2007)</td>
</tr>
<tr>
<td>U.S. 10,229</td>
<td>4.11 (%)</td>
<td>43,612</td>
<td>1.82% (1998–2007)</td>
</tr>
</tbody>
</table>
United States increased by 4.11 percent, on average, while the average increase in spending among OECD countries was 4.01 percent.

Instead, we find that South Korea’s average annual growth rates at both the primary and secondary education levels are among the highest in the OECD—though Norway’s growth rate at the secondary level was slightly higher than South Korea’s (see Table 2). Oddly, Norway’s spending growth rates at other levels of education were relatively low. Ireland and the United Kingdom also had unusually high rates of increase in spending at the primary and secondary levels of education, while Canada, Portugal, and Spain had the highest growth rates in spending at the tertiary level.

Obviously, we cannot expect to find a single and all pervasive explanation for the higher level of education outlays in the United States. Indeed, as just noted, this overall pattern is not at all pervasive—for instance, American outlays for secondary-level education are barely above the OECD average, while U.S. education spending at the tertiary level is significantly above average. Moreover, education spending data for the different countries included in our study are not readily comparable and differ substantially in the share of the outlays contributed by government rather than the private sector. Thus, the statistics underlying our national comparisons must be handled with caution.

But surely this cannot be the entire story. For in virtually every sector of the economy where the cost disease analysis is applicable, such as health care or the live performing arts, the same pattern seems to emerge: cost levels in the United States are atypically high, while rates of growth are near the average.

There is no easy explanation, but there is a plausible hypothesis. Beginning in the late nineteenth century, the U.S. economy began to expand at an unprecedented rate. At roughly the same time, both private and public expenditures on activities, such as education and health care, apparently started to grow rapidly in the United States—at rates much faster than in a number of European countries. (For instance, the American “robber barons” spent huge sums from their personal fortunes to build libraries, fund universities, and much more—thereby helping to increase the availability of these services.) Along with this, the total costs of these activities also grew, as the cost disease predicts. The result is that American spending on education, health care, and similar activities afflicted by the cost disease got a significant head start, even in comparison to other developed economies in Europe.

Many other factors contribute to higher-than-average education spending in the United States. For instance, U.S. education expenditures on non-educator employees (e.g., classroom aides and administrative staff) and facilities (e.g., transportation, sports, school lunches, etc.) are much higher than in other countries (Auguste, Kihn, & Miller, 2010, p. 41; Dillon, 2011, p. 22; Friedman, 2012, p. 116; OECD, 2011b, p. 28; 2011c, p. 28). In addition, one reviewer of this manuscript pointed out that in the United States’ special education costs and fringe benefits for teachers and other personnel (e.g., health insurance, pension, childcare, etc.) may be significantly higher than in other OECD countries, where such programs and benefits are not funded solely by education budgets. However, after reviewing the data we found no conclusive evidence on this point.5

All of these are valid points, but we argue that the key component of the explanation is the cost disease, which began afflicting the United States well before it reached other developed nations—though, ultimately, it has progressed no more rapidly here than elsewhere.

4. Quantitative analysis and methods

4.1. Data sources

Our main data source is the OECD’s online statistical database,6 which provides detailed data on educational expenditures for 30 OECD countries. The period of coverage is from 1988 to 2008, though for some countries the period of coverage is shorter and for many countries there are missing values over this time interval. Although most of the countries fall into the category of advanced industrialized countries, there are several that are more accurately considered middle-income countries, including Mexico, Turkey, the Czech Republic, the Slovak Republic, Poland, and Greece. Thus, our analysis reflects this large variation in per capita income levels.

The data show not only educational expenditures as a share of GDP, but also actual educational expenditure levels per pupil. The data are provided separately for three levels of schooling: primary, secondary, and tertiary. In addition, the OECD database provides details on educational expenditures by type. These are broken down into expenditures for educational personnel, educational administrative and professional support personnel, other current expenditures, and capital expenditures.

Our econometric estimation utilizes the variation of annual educational expenditures by country and year. We estimate whether or not educational expenditures’ share of GDP accelerates over time with overall labor productivity. We find that the relationship between the share of educational expenditures in GDP and labor productivity is non-linear, and the basic regression uses a logarithmic specification.7

Specifically, the reviewer pointed out that high costs associated with special education are charged directly to education budgets in the United States, while many other OECD countries fund special education through separate government agencies for children. Unfortunately, it was not possible to obtain data to confirm or rebut this idea. According to the OECD, no common definition of “special education” has been adopted by countries, as yet. As a result, the coverage of all data tables is extended to include special education, regardless of normal or special needs of students. Expenditures on special education, as defined nationally, are included at the school level (i.e., primary, secondary, or tertiary) in which it takes place (OECD, 2012b, pp. 6–7). In addition, for details on education costs related to health insurance, pension, and other fringe benefits, see footnote 9.


Indeed, during a recession the cost disease may no longer manifest its usual pattern because wages in all industries will tend not to grow, even when productivity increases.
We also made use of the data for different countries and at different dates to discern how behavior varies from period to period and from one country to another. We used both Ordinary Least Squares (OLS) and Generalized Method of Moments (GMM) estimators to elicit insights on country-specific effects (e.g., see Hall, 2005).

Another key independent variable in our econometric model is the overall level of labor productivity (LP). The cost disease model posits that the relative cost of an activity will rise if its rate of productivity growth is slower than average. Thus, the relative rise in educational expenses as a share of GDP, in general, will be greater as the rate of overall productivity growth increases. We use the OECD data to determine overall levels of productivity by country and year.

Another important independent variable in the econometric analysis is the number of students at each educational level. Since expenditures on education generally are higher as the number of students increases (though not necessarily), the number of students is another important part of the explanation for rising education costs. However, here again we find that the relationship between the number of students per capita and total educational expenditures, as a share of GDP, is non-linear, since class sizes vary across country and over time. (Note that data on the number of students come from the OECD database.)

4.2. Model specifications

The basic model analyzes how educational expenditures vary with country-wide average labor productivity and students per capita. We can write the ratio of educational expenses in current prices to GDP in current prices as follows:

$$\frac{\text{EDUCGDP}_{ct}}{\text{GDP}_{ct}/\text{HRS}_{ct}} = \frac{\left[\text{EDUC}_{ct}/\text{STUD}_{ct}\right]}{\left[\text{GDP}_{ct}/\text{HRS}_{ct}\right]}$$

$$= \frac{\left[\text{EDUC}_{ct}/\text{STUD}_{ct}\right]}{\left[\text{LP}_{ct}/\text{HRS}_{ct}\right]}$$

$$= \frac{\left[\text{EDUC}_{ct}/\text{STUD}_{ct}\right]}{\left[\text{PPPED}_{ct}/\text{EMPPPOP}_{ct}\right]}$$

where \(\text{EDUC}_{ct}\) is annual educational expenditures in current prices in country \(c\) at time \(t\); \(\text{GDP}_{ct}\) is GDP in current prices in country \(c\) at time \(t\); \(\text{STUD}_{ct}\) is the number of students in country \(c\) at time \(t\); \(\text{HRS}_{ct}\) is total hours worked in country \(c\) at time \(t\); \(\text{EDUCGDP}_{ct}\) is the ratio of annual educational expenditures to GDP for country \(c\) at time \(t\); \(\text{LP}_{ct}\) is the average labor productivity of country \(c\) at time \(t\); \(\text{STUD}_{ct}/\text{POP}_{ct}\) is the ratio of annual educational expenditures to GDP for country \(c\) at time \(t\); \(\text{PPPED}_{ct}\) is the PPP exchange rate for educational output of country \(c\) at time \(t\); \(\text{STUD}_{ct}/\text{POP}_{ct}\) is the ratio of students in country \(c\) at time \(t\); \(\text{EMPPPOP}_{ct}\) is the ratio of employment in hours to population in country \(c\) at time \(t\); and \(\text{EMPPPOP}_{ct}\) is the ratio of employment in hours to population in country \(c\) at time \(t\).

Suppose that overall labor productivity in country \(c\) grows at a constant annual rate of \(r_{1c}\) and the productivity of the education sector in country \(c\) grows at a constant rate of \(r_{2c}\). Moreover, suppose that \(\text{PPPED}_{ct}\) changes at a constant rate of \(s_{1c}\) over time and that \(\text{EMPPPOP}_{ct}\) changes at a constant rate of \(s_{2c}\) over time. Then,

$$\text{EDUCGDP}_{ct} = \left(\frac{\text{EDUC}_{ct}/\text{STUD}_{ct}}{\text{GDP}_{ct}/\text{HRS}_{ct}}\right) \cdot \left(\frac{\text{PPPED}_{ct}/\text{EMPPPOP}_{ct}}{\text{STUD}_{ct}/\text{POP}_{ct}}\right)$$

$$= \left(\frac{\text{EDUC}_{ct}/\text{STUD}_{ct}}{\text{LP}_{ct}/\text{HRS}_{ct}}\right) = \left(\frac{\text{EDUC}_{ct}/\text{STUD}_{ct}}{\text{PPPED}_{ct}/\text{EMPPPOP}_{ct}}\right)$$

where the subscript 0 indicates the value of the variable at time 0. In natural logarithms, this becomes

$$\ln(\text{EDUCGDP}_{ct}) = \ln(\text{EDUC}_{ct}) + r_{2c}t - \ln(\text{LP}_{ct}) - r_{1c}t$$

$$+ s_{2c}t - s_{1c}t - \ln(\text{STUD}_{ct}) - \ln(\text{EMPPPOP}_{ct})$$

and

$$\ln(\text{EDUCGDP}_{ct}) = \ln(\text{CNY}_{c}) + [r_{2c}t - r_{1c}t + (s_{2c} - s_{1c})t]t$$

$$+ \ln(\text{STUD}_{ct}) - \ln(\text{EMPPPOP}_{ct}).$$

Since \(r_{2c}\) and \(s_{2c}\) are not known, the corresponding estimating form becomes

$$\ln(\text{EDUCGDP}_{ct}) = \beta_{0} + \beta_{1} \ln(\text{STUD}_{ct}) + \beta_{2} \ln(\text{EMPPPOP}_{ct}) + \sum_{c} \varphi_{c} \ln(\text{CNY}_{c})$$

$$+ \epsilon_{ct}$$

where \(\text{TIME}_{e}\) is time, defined as current year minus 2007; \(\text{CNY}c\) is a set of dummy variables for countries; and \(\epsilon_{ct}\) is a stochastic error term assumed to be identically and independently distributed (i.i.d.).

The key coefficient of interest is \(\beta_{1}\). What would we expect the sign of \(\beta_{1}\) to be? We would expect that overall rate of labor productivity growth to exceed that of the educational sector (that is, for \(r_{2c}\) to be greater than \(r_{1c}\)), so that the term \((r_{2c} - r_{1c})\) should be negative. On the other hand, we would anticipate that the relative price of educational output would rise over time, so that the term \((s_{2c} - s_{1c})\) should be positive. Would the two terms cancel each other out? In general, the answer is no, since the first term is the difference in labor productivity growth between the education sector and the total economy, whereas the second term largely reflects differences in total factor productivity (TFP) growth between the two. In general, the difference in TFP growth will not equal the difference in labor productivity growth. However, it is not a priori clear which difference would be greater (in absolute value).

We would also expect that the coefficient \(\beta_{2}\) is positive, since educational spending should, in general, rise with the number of students. We would predict that the coefficient \(\beta_{3}\) is negative, on the basis of Eq. (2). With regard to the country dummy variables, of particular interest will be the coefficient on the U.S. dummy variable. If the value of the
coefficient is positive, relative to the mean of the other country dummy variables, this result will indicate that the United States is experiencing greater than average levels of educational spending.

4.3. Descriptive statistics

Table 3 shows basic statistics for the key variables used in our analysis. Of primary interest (as an indicator of affordability) is the variable EDUCGDP, the ratio of educational expenditures to GDP in current prices. Its average value over the 30 countries and 11 years was 5.94 percent. Moreover, its mean value grew from 4.91 percent in 1998 to 6.99 percent in 2008, yielding an average annual increase of 0.21 percentage points.\(^8\) Average labor productivity (LP)—that is, the value of output per worker—grew by 20 percent over this period, or by 1.8 percent per year. The average ratio of students to population was 0.238. This ratio, on average, remained fairly constant over the period. The ratio of employment to population averaged 0.450 and grew by 0.028 over the 10-year stretch.

Next we consider the different components of educational expenditures, which include the compensation of educational personnel\(^9\) (68 percent), non-personnel costs (22 percent), and capital expenditures (9 percent).\(^10\) All three components increased, as a share of GDP, over the decade. Secondary education made up the largest share of educational expenditures (39 percent), followed by primary education (27 percent) and tertiary education (25 percent).\(^11\) These three components also rose, as a share of GDP, from 1998 to 2008—though these increases were more moderate in relative terms than in terms of total educational spending. The same ranking also holds for the compensation of educational personnel by school level, as well as for the number of students by schooling level. The share of educational compensation in GDP rose modestly at all three levels of schooling. However, primary school students, as a percentage of the population, actually fell, on average, over the 10 years. In contrast, the ratio of secondary students to the total population, on average, remained almost constant; and students in higher education increased modestly, relative to the total population.

Whereas the United States ranks highest in total educational expenditures per student (in PPPS)—slightly ahead of second-place Switzerland—it is only slightly above average in the ratio of total educational expenditures in current prices to GDP in current prices (0.078 vs. an average of 0.068) and only slightly above average in the ratio of total educational expenditures per student in current prices to GDP per capita in current prices (0.312 vs. an average of 0.284). Iceland actually ranks first in terms of the ratio of total educational expenditures to GDP (0.106), and Turkey ranks first in terms of the ratio of total educational expenditures per student to GDP per capita (0.379).

We find a positive correlation between real educational expenditures per student and the level of labor productivity across OECD countries (see Fig. 1). The correlation coefficient is 0.778. Here, too, the United States lies above the regression trend line. This result is in accord with the cost disease model.

Figs. 2–6 show a similar set of results for selected components of total educational spending. As in the case of total educational expenditures, there is a positive correlation between real compensation of educational personnel per student and the level of labor productivity across OECD countries (see Fig. 3). The correlation coefficient is 0.672, and again the United States lies above the regression trend line.

As can be seen in Fig. 4, the correlation between real primary school expenditures per student and labor productivity is about the same as that between real educational expenditures per student and labor productivity (0.78 in both cases).\(^12\) As shown in Fig. 5, the correlation between real secondary school expenditures per student and labor productivity is stronger; the correlation coefficient between real educational expenditures per student and labor productivity is 0.85 compared to 0.79. Here the U.S. data point is only slightly above the regression line. Finally, as shown in Fig. 6, the correlation between real tertiary education expenditures per student and labor productivity is stronger, 0.60, and the U.S. data point is again above the regression line.

4.4. Regression results

The first column of Table 4 shows the regression results for Eq. (3) using OLS. First we note that the estimated

---

\(^8\) It should be noted that the sample of countries may change over time due to missing values.

\(^9\) Note that, according to the OECD, compensation of educational personnel includes both salaries and non-salary compensation. The latter consists of employer contributions to retirement plans (including public programs like Social Security), employer spending on health care or health insurance, disability insurance, unemployment compensation, maternity and childcare benefits, other forms of social insurance, non-cash benefits like free or subsidized housing, free or subsidized child care, and other fringe benefits (OECD, 2012b, pp. 76–77). There is a great deal of country-to-country variation in the types of programs included in this category. The OECD does not attempt to provide consistency in this category across countries.

\(^10\) These three components do not add up to 100 percent probably because of missing values.

\(^11\) Once again, these components do not add up to 100 percent probably because of missing values.

\(^12\) Note that there are some statistical issues regarding how expenditures are disaggregated by level of education for the United States and the other countries included in this study. For the United States, much of education is found in K-12 districts (or even in districts that provide adult education and pre-school, as well). Short of a uniform accounting system and an effort to apply this in a highly decentralized system, it is not clear where the breakdowns come from, and this also may be true for other countries in ours study. According to the OECD, each country is required to provide a breakdown of educational expenses by level of education (OECD, 2012b, pp. 86–87). The basic unit of classification is the educational program, which is defined according to gradations of learning experiences and the competencies built into the design of the educational program. Each country's statistical office is required to provide a breakdown of educational expenses by level of education. The actual allocation of educational expenditures is country-specific. In the case of consolidated educational budgets, it is likely that the expenses are allocated to each level of education on the basis of the number of students at each level or the number of teaching personnel.
Table 3
Descriptive statistics of key regression variables.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUCCGDP</td>
<td>0.0594</td>
<td>0.0165</td>
<td>285</td>
<td>0.0491</td>
<td>0.0699</td>
<td>0.0208</td>
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<tr>
<td>LP</td>
<td>68.95</td>
<td>25.69</td>
<td>330</td>
<td>62.07</td>
<td>74.29</td>
<td>12.22</td>
</tr>
<tr>
<td>STUDPOP</td>
<td>0.238</td>
<td>0.037</td>
<td>322</td>
<td>0.235</td>
<td>0.235</td>
<td>0.0003</td>
</tr>
<tr>
<td>EMPPOP</td>
<td>0.456</td>
<td>0.060</td>
<td>328</td>
<td>0.436</td>
<td>0.466</td>
<td>0.0282</td>
</tr>
<tr>
<td>COMPGDP</td>
<td>0.0401</td>
<td>0.0120</td>
<td>260</td>
<td>0.0339</td>
<td>0.0467</td>
<td>0.0128</td>
</tr>
<tr>
<td>NONPGDP</td>
<td>0.0128</td>
<td>0.0057</td>
<td>260</td>
<td>0.0103</td>
<td>0.0158</td>
<td>0.0055</td>
</tr>
<tr>
<td>CAPGDP</td>
<td>0.0051</td>
<td>0.0028</td>
<td>257</td>
<td>0.0046</td>
<td>0.0056</td>
<td>0.0010</td>
</tr>
<tr>
<td>PRIMGDP</td>
<td>0.0162</td>
<td>0.0069</td>
<td>286</td>
<td>0.0130</td>
<td>0.0183</td>
<td>0.0053</td>
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<td>SCNDGDP</td>
<td>0.0234</td>
<td>0.0059</td>
<td>234</td>
<td>0.0203</td>
<td>0.0262</td>
<td>0.0059</td>
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<tr>
<td>TERTGDP</td>
<td>0.0148</td>
<td>0.0054</td>
<td>291</td>
<td>0.0120</td>
<td>0.0179</td>
<td>0.0059</td>
</tr>
<tr>
<td>PRIMCOMPGDP</td>
<td>0.0116</td>
<td>0.0060</td>
<td>263</td>
<td>0.0066</td>
<td>0.0127</td>
<td>0.0051</td>
</tr>
<tr>
<td>SCNDCOMPGDP</td>
<td>0.0020</td>
<td>0.0051</td>
<td>215</td>
<td>0.0181</td>
<td>0.0224</td>
<td>0.0044</td>
</tr>
<tr>
<td>TERTCOMPGDP</td>
<td>0.0088</td>
<td>0.0034</td>
<td>271</td>
<td>0.0073</td>
<td>0.0110</td>
<td>0.0037</td>
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<tr>
<td>PRIMSTUDPOP</td>
<td>0.077</td>
<td>0.026</td>
<td>313</td>
<td>0.0819</td>
<td>0.0706</td>
<td>−0.0013</td>
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<tr>
<td>SCNDSTUDPOP</td>
<td>0.094</td>
<td>0.019</td>
<td>301</td>
<td>0.0922</td>
<td>0.0929</td>
<td>0.0007</td>
</tr>
<tr>
<td>TERTSTUDPOP</td>
<td>0.039</td>
<td>0.012</td>
<td>308</td>
<td>0.0340</td>
<td>0.0422</td>
<td>0.0082</td>
</tr>
</tbody>
</table>

Natural logarithms

- \ln(\text{EDUCCGDP}) = −2.88
- \ln(\text{COMPGDP}) = −3.28
- \ln(\text{NONPGDP}) = −4.48
- \ln(\text{CAPGDP}) = −5.44
- \ln(\text{PRIMGDP}) = −4.23
- \ln(\text{SCNDGDP}) = −3.80
- \ln(\text{TERTGDP}) = −4.29

Key: (1) EDUCCGDP: ratio of total educational expenditures in current prices to GDP in current prices; (2) LP: ratio of GDP in 2010 US dollars to hours worked; (3) STUDPOP: ratio of total number of students to the total population; (4) EMPPOP: ratio of total employment to the total population; (5) COMPGDP: ratio of total compensation of educational personnel to GDP in current prices; (6) NONPGDP: ratio of total non-personnel educational expenditures to GDP in current prices; (7) CAPGDP: ratio of total capital educational expenditures to GDP in current prices; (8) PRIMGDP: ratio of total primary school expenditures in current prices to GDP in current prices; (9) SCNDGDP: ratio of total secondary school expenditures in current prices to GDP in current prices; (10) TERTGDP: ratio of total tertiary school expenditures in current prices to GDP in current prices; (11) PRIMCOMPGDP: ratio of primary school compensation of educational personnel to GDP in current prices; (12) SCNDCOMPGDP: ratio of secondary school compensation of educational personnel to GDP in current prices; (13) TERTCOMPGDP: ratio of tertiary school compensation of educational personnel to GDP in current prices; (14) PRIMSTUDPOP: ratio of the number of primary school students to the total population; (15) SCNDSTUDPOP: ratio of the number of secondary school students to the total population; (16) TERTSTUDPOP: ratio of the number of tertiary school students to the total population.

The coefficient of TIME ($\beta_1$) is positive and significant at the one-percent level. The results indicate that the relative price effect between the education sector and the total economy dominates the relative labor productivity growth effect. The coefficient estimate of $\beta_1$ is 0.045. This can be interpreted to mean that over this period among these 30 countries, the average rate of increase of the ratio of educational spending to GDP was 4.53 percent per year. This value is consistent with the annual average change in $\ln(\text{EDUCCGDP})$—that is, the natural logarithm of the ratio of total educational expenditures to GDP (in current prices)—of 0.036 (see Table 1). In addition, the coefficient estimate for $\ln(\text{STUDPOP})$—that is, the natural logarithm of the ratio of the total number of students to the total population—is positive, as predicted, and significant at the one-percent level, while that for $\ln(\text{EMPPOP})$—that is, the natural logarithm of the ratio of total employment to the total population—is negative, as predicted, and also significant at the one-percent level.

The coefficient for the U.S. dummy variable is 0.413, which is significant at the one-percent level, relative to the omitted country (Australia). A more interesting statistic is the U.S. coefficient minus the average value of the dummy variables of the other 29 countries. Its value is 0.263. This result can be interpreted to mean that even after controlling for differences in the ratio of the student population to the total population and the ratio of employment to population, the ratio of educational spending to GDP is, on average over the period, 26.3 percent higher than the OECD average. Here it is important to note that the $R^2$ statistic’s value, 0.87, is very high because of the presence of country dummy variables.

An alternative estimation using GMM comes from taking the first differences of Eq. (3) as follows:

$$
\Delta \ln(\text{EDUCCGDP}_{ct}) = \beta_1 + \beta_2 \Delta \ln(\text{STUDPOP}_{ct}) + \beta_3 \Delta \ln(\text{EMPPOP}_{ct}) + \epsilon_{ct} \quad (4)
$$

where $\Delta$ refers to the annual difference in variable values and the error term $\epsilon_{ct}$ is now, by construction, auto-correlated. The constant term $\beta_1$ in Eq. (4) refers to the same coefficient as the coefficient on TIME in Eq. (3). As shown in column 2 of Table 4, the coefficient of TIME is similar to the OLS estimate. Moreover, it remains significant at the one-percent level. The coefficient estimate for $\ln(\text{STUDPOP})$—that is, the natural logarithm of the ratio of the total number of students to the total population—is, as before, positive, and significant at the one-percent level, while that for $\ln(\text{EMPPOP})$—that is, the

---

13 The sample size is 278, rather than 341 (31 x 11), because of the existence of a large number of missing values.
natural logarithm of the ratio of total employment to the total population—is negative, though no longer significant.

Next we look at different components of total educational spending. The first is the total compensation of educational personnel, COMP. This component made up, on average—over the 30 countries and 11 years, 63.3 percent of total educational expenditures. We would expect that this component is most strongly subject to the cost disease because it represents pure labor costs. The OLS results, shown in the third column of Table 4, confirm that the coefficient estimates for ln(COMPGDP)—that is, the natural logarithm of the ratio of total compensation of educational personnel to GDP (in current prices)—are very similar to those for ln(EDUCGDP)—that is, the natural logarithm of the ratio of total educational expenditures to GDP (in current prices). This is true, despite the fact that the cross-sectional profiles in 2006 look very different between COMPGDP—that is, the ratio of total compensation of educational personnel to GDP (in current prices)—and EDUCGDP—that is, the ratio of total educational expenditures to GDP (in current prices)—(see Table 4). For the key variable, TIME, the coefficient estimate is now 0.0435, compared with a value of 0.0453 in column 1 of Table 4, and both coefficients are significant at the one-percent level. The coefficient estimate for ln(STUDPOP)—that is, the natural logarithm of the ratio of the total number of students to the total population—is still positive, though lower in value, and still significant at the one-percent level. However, the coefficient for ln(EMPPPOP)—that is, the natural logarithm of the ratio of total employment to the total population—is still negative, though greater in absolute value, and still significant at the one-percent level. The value of the U.S. coefficient minus the average value of the dummy variables of the other 29 countries is now 0.398, compared to a value of 0.263 in column 1 of Table 4.

The second component is non-personnel educational spending, [ln(NONPGDP)]. We did not expect that this component would be subject to the cost disease to the same extent as educational personnel costs, but the results indicate otherwise. The coefficient estimate for TIME, defined as the calendar year—1997, is now 0.0646, which is even higher than the coefficient value of 0.0453 in column 1 of Table 4. Both coefficients are significant at the one-percent level. The coefficient estimate for ln(STUDPOP)—that is, the natural logarithm of the ratio of the total number of students to the total population—is still positive, though lower in value than for ln(EDUCGDP)—that is, the natural logarithm of the ratio of total educational expenditures to GDP (in current prices), and still significant at the one-percent level. Meanwhile, that for ln(EMPPPOP)—that is, the natural logarithm of the ratio of total employment to the total population—remains negative, is greater in absolute value than that for ln(EDUCGDP)—that is, the natural logarithm of the ratio of total educational expenditures to GDP (in current prices), and is still significant at the one-percent level. The value of the U.S. coefficient minus the average value of the dummy variables of the other 29 countries is 0.512, which

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>ln(EDUCGDP)</th>
<th>ln(COMPGDP)</th>
<th>ln(NONPGDP)</th>
<th>ln(CAPGDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−2.20**</td>
<td>−3.513**</td>
<td>−4.823**</td>
<td>−3.487**</td>
</tr>
<tr>
<td>ln(STUDPOP)</td>
<td>1.377**</td>
<td>0.917**</td>
<td>1.203**</td>
<td>1.216**</td>
</tr>
<tr>
<td>ln(EMPPPOP)</td>
<td>−1.082**</td>
<td>−1.531**</td>
<td>−2.423**</td>
<td>0.258</td>
</tr>
<tr>
<td>TIME</td>
<td>0.0453*</td>
<td>0.0398*</td>
<td>0.0646**</td>
<td>0.0255**</td>
</tr>
<tr>
<td>Country dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>included**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. coeff. minus the</td>
<td>0.263</td>
<td>0.298</td>
<td>0.512</td>
<td>0.519</td>
</tr>
<tr>
<td>mean of the other 29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.865</td>
<td>0.884</td>
<td>0.879</td>
<td>0.882</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.848</td>
<td>0.868</td>
<td>0.862</td>
<td>0.866</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.143</td>
<td>0.143</td>
<td>0.207</td>
<td>0.225</td>
</tr>
<tr>
<td>Root mean square</td>
<td>0.395</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>error</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimation method</td>
<td>OLS</td>
<td>GMM*</td>
<td>OLS</td>
<td>OLS</td>
</tr>
<tr>
<td>Sample size</td>
<td>278</td>
<td>214</td>
<td>253</td>
<td>250</td>
</tr>
</tbody>
</table>

Note: The sample consists of panel data, with observations on each of 31 countries by year from 1998 to 2008. Robust standard errors are used. The absolute value of the t-statistic is shown in parentheses below the coefficient estimate. See notes to Table 1 for the key. In addition, TIME: Calendar year minus 1997.

* Australia is the excluded country.
* The GMM instrument is ln(COMPGDP).
* Significance level: 10%.
* Significance level: 5%.
** Significance level: 1%.

14 GMM could not be used for ln(COMPGDP) because too many observations were missing.

15 Once again, GMM could not be used for ln(NONPGDP) because of too many missing observations.
Table 5
Regressions of educational expenditures by level of schooling as a percent of GDP.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent variable</th>
<th>ln(PRIMGDP)</th>
<th>ln(SCNDGDP)</th>
<th>ln(TERTGDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td>−2.240**</td>
<td>−2.612**</td>
<td>−3.043**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.78)</td>
<td>(5.96)</td>
<td>(7.89)</td>
</tr>
<tr>
<td>ln(STUDPOP)b</td>
<td></td>
<td>1.039**</td>
<td>0.546**</td>
<td>0.632**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.20)</td>
<td>(4.13)</td>
<td>(7.92)</td>
</tr>
<tr>
<td>ln(EMPPOP)</td>
<td></td>
<td>−0.565</td>
<td>0.261</td>
<td>−0.860</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.46)</td>
<td>(0.71)</td>
<td>(2.86)</td>
</tr>
<tr>
<td>TIME</td>
<td></td>
<td>0.0478**</td>
<td>0.0335**</td>
<td>0.0372*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10.84)</td>
<td>(9.00)</td>
<td>(9.94)</td>
</tr>
<tr>
<td>Country dummies includeda</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>U.S. coeff. minus the mean</td>
<td>0.170</td>
<td>0.022</td>
<td>0.516</td>
<td></td>
</tr>
<tr>
<td>value of the other 29 countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>0.914</td>
<td>0.9027</td>
<td>0.929</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td></td>
<td>0.904</td>
<td>0.8894</td>
<td>0.921</td>
</tr>
<tr>
<td>Standard error</td>
<td></td>
<td>0.158</td>
<td>0.108</td>
<td>0.118</td>
</tr>
<tr>
<td>Root mean square error</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimation method</td>
<td></td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
</tr>
<tr>
<td>Sample size</td>
<td></td>
<td>284</td>
<td>234</td>
<td>287</td>
</tr>
</tbody>
</table>

Note: The sample consists of panel data, with observations on each of 31 countries by year from 1998 to 2008. Robust standard errors are used. The absolute value of the t-statistic is shown in parentheses below the coefficient estimate. See notes to Table 1 for the key. In addition, TIME: calendar year minus 1997.

a Australia is the excluded country.
b Primary students only, secondary students only, and tertiary students only, used, respectively, in the three regression equations.

# Significance level: 10%.
* Significance level: 5%.
** Significance level: 1%.

is much higher than the comparable value of 0.263 in column 1 of Table 4.

The third component is educational capital expenditures, given as a share of GDP [ln(CAPGDP)]. Once again, the results indicate that this component is subject to the cost disease.\(^{16}\) The coefficient estimate for TIME is 0.0255, which is lower than the coefficient value of 0.0453 for total educational spending, given as a share of GDP. Both coefficients are significant at the one-percent level. The coefficient estimate for ln(STUDPOP)—that is, the natural logarithm of the ratio of the total number of students to the total population—is still positive, though again it is lower in value than it is for ln(EDUCGDP)—that is, the natural logarithm of the ratio of total educational expenditures to GDP (in current prices)—and still significant at the one-percent level. Meanwhile, the coefficient for ln(EMPPOP)—that is, the natural logarithm of the ratio of total employment to the total population—is positive but insignificant. The value of the U.S. coefficient minus the average value of the dummy variables of the other 29 countries is 0.519, which again is much higher than the comparable value of 0.263 in column 1 of Table 4. This means that America’s educational capital expenditures per dollar of GDP are about 52 percent higher than the average of the other OECD countries.

In Table 5, we look at the same set of regression results by level of education: primary, secondary, and tertiary.\(^{17}\) Again results are quite similar both among the three sets and to our results for total educational spending as a share of GDP. The coefficient on TIME, defined as the calendar year—1997, is positive and significant at the one-percent level. Its value ranges from a low of 0.335 for secondary educational spending as a share of GDP to a high of 0.0478 for the ratio of primary spending spending to GDP. The coefficient estimate for ln(STUDPOP)—that is, the natural logarithm of the ratio of the total number of students to the total population—is positive and significant at the one-percent level in all three cases.\(^{18}\) However, the coefficient of ln(EMPPOP)—that is, the natural logarithm of the ratio of total employment to the total population—is negative, as predicted, and significant only in the third regression (at the one-percent level). The value of the U.S. coefficient minus the average value of the dummy variables of the other 29 countries is 0.170 in the primary-school regression, 0.022 in the secondary-school regression, and 0.516 in the tertiary-school regression. The results indicate that education spending as a share of GDP, after controlling for the number of students as a share of the population, is 17 percent greater than the OECD average in the United States at the primary-school level and 52 percent greater at the tertiary-school level, but only 2 percent greater at the secondary-school level. The results for secondary-school spending are in accord with the cross-sectional results (shown in Table 5) that the United States lies very close to the regression trend line in terms of secondary-school spending as a share of GDP in 2006. That is, such spending

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\(^{16}\) Once again, GMM could not be used for ln(CAPGDP) because of too many missing observations.

\(^{17}\) Because of missing values, GMM could not be used in any of these regressions.

\(^{18}\) We include primary school students only, secondary school students only, and tertiary school students only in the three regression equations, respectively.
in the United States is very close to the norm for the other countries in our study.

4.5. Findings

The cross-sectional results for year 2006 support the cost disease model. Correlation coefficients between real educational spending per student and labor productivity always were positive, which clearly is in accord with the cost disease model.

Regression results based on pooled, time-series, cross-sectional data and Eq. (3) provide strong confirmation of the cost disease model. The coefficient on TIME, after controlling for the effects of the ratio of the number of students to the total population and employment as a share of the population, is positive and significant at the one-percent level for total educational spending as a share of GDP, the compensation of educational personnel as a share of GDP, non-personnel educational spending as a proportion of GDP, primary-school spending as a share of GDP, secondary-school spending as a proportion of GDP, and the ratio of tertiary-school spending to GDP.

In addition, our findings indicate that U.S. total educational spending as a share of GDP is about is 26 percent higher than the average of the other OECD countries even after controlling for the effects of the ratio of the number of students to the total population and employment as a share of the population. The share of educational personnel compensation as a share of GDP is 30 percent higher than the OECD average in the United States, that of the ratio of non-personnel costs to GDP is 51 percent higher, and that of the ratio of capital expenditures to GDP is 52 percent higher. Moreover, the share of primary school spending in GDP is 52 percent higher than the OECD average in the United States. In contrast, the share of primary-school spending to GDP is only 17 percent higher, while secondary-school spending is just 2 percent higher than the OECD average.

5. A comparison of four education systems: implications for education policy

Data alone are insufficient as reliable guides for policy. Consequently, we also carried out a more extensive investigation of educational institutions and practices in a sub-sample of individual countries that are statistical outliers—that is, countries that, according to our data, have extremely low or high educational costs and extremely weak or strong student performances.19 This section of our report seeks to provide insights into the influences that lead to desirable (or undesirable) educational outcomes.

We selected two of the countries in our sub-sample, Finland and South Korea, for their apparently low education costs (relative to their per capita incomes), coupled with their reportedly successful educational outcomes. The other two countries, Norway and the United States, were selected (aside from our obvious interest in the United States) because their education costs are high (relative to their per capita incomes), while their reported educational outcomes are middling to poor.

5.1. On education in Finland and South Korea

As noted, Finland and South Korea spend far less on education than the OECD average (see Fig. 1), though students in these two countries are among the top scorers on the PISA math and literacy tests. Finland and South Korea did not always have such exemplary education systems, however. Roughly half a century ago both countries were relatively poor and undeveloped, with largely uneducated populations and inadequate education systems (Sahlberg, 2010, p. 43; Seth, 2002, p. 249). But in the late 1950s (South Korea) and the 1970s (Finland), they began to focus on improving and expanding their education systems, with the aim of supplying educated workers for jobs in their respective high tech- and services-driven economies (Adams & Gottlieb, 1993, p. 176; OECD, 2010, pp. 119, 121; Weidman & Park, 2002). In order to achieve their remarkable expansion and quality improvements in education in such short periods of time, Finland and especially South Korea focused their efforts on primary and secondary education, rather than higher education (Adams & Gottlieb, 1993, pp. 157–158; Morris, 1996, p. 107; Sahlberg, 2010). In addition, both focused on building well-trained teaching forces (Kang & Hong, 2008, p. 201; OECD, 2010, p. 129), and Finland, in particular, sought to provide equal education to all students (Partanen, 2011; Seth, 2002, p. 4).

But Finland’s and South Korea’s approaches to education differ in several important ways. Finnish schools are run at the local level with little direct input from the federal government, and classes are small and informal (OECD, 2010, pp. 124, 126; Vasagar, 2010). Classroom instruction emphasizes hands-on problem solving, experimentation, and cooperation among students (Darling-Hammond, 2010, p. 170; Sahlberg, 2010, p. 126). Teachers are encouraged to collaborate and innovate in order to create new, more effective teaching methods (Darling-Hammond, 2010, p. 172; Sahlberg, 2010, p. 127; Valijarvi, Linnakyla, Kupari, Reiniikainen, & Arfman, 2002, p. 46). In contrast, in South Korea the federal government exercises direct control over schools (e.g., hiring/firing teachers and administrators, selecting textbooks, setting admissions limits for colleges and universities), though this orientation has decreased since the 1990s (Adams & Gottlieb, 1993, p. 214; Darling-Hammond, 2010, p. 176; Guo, 2005, pp. 80–81; Kim, 2002, p. 36; Seth, 2002, p. 250). South Korean classes are strictly structured (e.g., corporal punishment has only recently been forbidden). The pedagogy typically focuses on lectures and memorization (Kim, 2002, p. 37; Seth, 2002, p. 250; Sorensen, 1994, p. 27), with the aim of preparing students to do well on South Korea’s high-stakes college entrance exam (Adams & Gottlieb, 1993, p. 214; Darling-Hammond, 2010, p. 177; Joo, 2000, p. 98; Seth, 2002, pp. 5, 255). South Korean students compete frantically with one another for admission to a handful of elite universities that serve as the

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19 We used math and literacy scores on the Program for International Student Assessment (PISA), administered by the OECD to 15-year-old students in more than 70 countries and economies, to measure educational outcomes. We compared this against education spending data from the OECD for the same year (2006).
conduit to well-paid, prestigious professional careers (Park & Weidman, 2000, p. 179; Seth, 2002, p. 3).

There also are clear differences in how the two countries fund their education systems. Finland’s system is totally public, federally funded, and tuition-free at all levels (Sahlberg, 2010, p. 71; Tung, 2012). In order to control increases in educational spending, Finland keeps overhead spending as low as possible and focuses spending on classroom resources, such as lab equipment, books, and computers. Thus, administrative bodies (and their salaries) are small, spending on standardized testing and extracurricular activities is minimal, and teacher salaries are moderate (OECD/ Pearson Foundation, 2010, p. 2; OECD, 2010, p. 130; Sahlberg, 2010, p. 43). In addition, Finland’s “welfare state” eases the burden on schools by providing excellent comprehensive support for students (e.g., health care, counseling, school supplies, and even meals) (OECD, 2010, p. 123; Sahlberg, 2010, pp. 48, 115; Valijarvi et al., 2002, p. 46). Still, Finland has struggled in recent years to keep up with rapidly rising education costs. Much lauded for its famously small schools and class sizes, it recently has been forced to close and/or merge some of its smaller schools in order to create larger, more cost saving substitutes (Kaiser, 2005a, 2005b).

In contrast, in an effort to control education costs, the South Korean government systematically underfunds public education (Adams & Gottlieb, 1993, p. 81; OECD, 2008, pp. 9, 11). Such fiscal stringency has resulted in famously large class sizes and, until very recently, poorly maintained/equipped schools (OECD and Pearson Foundation, 2010; Seth, 2002, p. 250). Thus, in South Korea only primary education is free, and the government relies substantially on private, tuition-based schools and out-of-pocket spending by families (Adams & Gottlieb, 1993, p. 214; Guo, 2005, pp. 87, 89). Indeed, perhaps to compensate for such deficient schools, a majority of South Korean students pay for private tutoring when preparing for the all-important college entrance examination (Sorensen, 1994, p. 22). In effect, significant portions of educational costs in South Korea are not covered by the government but are left to be paid by families and, hence, are perhaps not fully and accurately represented in our data on expenditures (Seth, 2002, p. 172). Thus, South Korea’s apparently low education spending isn’t low at all—the data merely fail to account for the substantial proportion of education spending that the South Korean government has transferred to South Korean families and the entrepreneurs who establish and run private, tuition-based schools and tutoring facilities.

Finally, our finding that both Finland and South Korea excel at the efficient provision of elementary and secondary education—but not university education—is significant. In both countries research programs at colleges and universities are under-developed and, especially in South Korea, reportedly of inferior quality (Kim & Lee, 2006, p. 570; Seth, 2002, pp. 236, 252). Higher education in South Korea is constrained by poor funding, while unstructured curriculum and a lack of internal competition are noted problems in Finland’s universities (Burt & Namgi, 2009, p. 274; Raivola, 2000, p. 134). This implies that both the Finnish and South Korean education systems focus on teaching “known facts,” rather than the ability to generate creative ideas and exercise the imagination—though the latter arguably lays the foundation for innovation and economic progress (Seth, 2002, p. 243).21

5.2. On education in Norway and the United States

In contrast to Finland and South Korea, education costs in Norway and the United States are well above the OECD average (see Fig. 1), while students’ scores on the PISA math and literacy tests are mediocre at best.

The causes of these poor outcomes are not immediately apparent. Both Norway and the United States have long traditions of providing relatively egalitarian mass education (Harwood, 1979; Hofstadter, 1962, p. 299; Opheim, 2004, p. 12; Rust, 1990, pp. 16, 249–250). Both also enjoy relative prosperity—though in Norway this is a fairly recent occurrence, resulting from the rapid development of its oil industry in the 1980s and 1990s (Lyng & Blichfeldt, 2003, p. 10). Half a century of exceptional prosperity in the United States has resulted in notably inequitable distribution of wealth and property (Books, 2004, p. 86; Wiener & Pristoop, 2006, p. 9), but Norway (with its comprehensive “social welfare state”) has managed to minimize such inequality (Stephens, Tonnessen, & Kyriacou, 2004, p. 113).

Interestingly, education in the United States is funded mainly by local property tax revenues and, thus, varies significantly from one locality to another (Books, 2004, p. 86; Darling-Hammond, 2007, p. 319; Wiener & Pristoop, 2006, p. 9). This system “links the quality of a child’s schooling to the affluence or poverty of the child’s family and neighbors” (Books, 2004, p. 86) and “inherently gives wealthier communities an advantage in providing better educational opportunities” (Wiener & Pristoop, 2006, p. 9). Thus, inequalities in educational access and performance in the United States reflect the larger socioeconomic inequalities in American society (OECD, 2011b, p. 34).23 Similarly, education policymaking and

21 It is perhaps not surprising, then, that Finland and South Korea are not noted for strong entrepreneurial traditions (Acs & Szerb, 2012) and, moreover, have produced relatively few Nobel laureates. Indeed, Finns and South Koreans claimed a combined total of five Nobel prizes between 1975 and 2010, while 338 Americans won Nobel prizes during that time period.
22 For instance, Darling-Hammond (2007) notes that “the wealthiest 10% of school districts in the United States spend nearly 10 times more than the poorest 10%, and spending ratios of 3 to 1 are common within states” (319).
23 As of 2010, the Gini index of income inequality (0 = complete equality; 1 = complete inequality) for the United States was 0.38. In comparison, Gini indices for Norway (0.25), Finland (0.26), and South Korea (0.319) were substantially lower (OECD StatExtracts: http://stats.oecd.org/). Thus, as Ravitch (2012) argues, “[t]o the extent that we [in the United States] reduce poverty, we will improve student achievement.”

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20 The data appear to be consistent with these observations. In 2006 South Korean households spent just over 2.75 percent of GDP on private tutoring for students in primary and secondary school (Kim & Lee, 2010, p. 261). In comparison, the South Korean government spent 3.5 percent of GDP on primary, secondary, and (non-tertiary) post-secondary education in 2003 (Kim & Lee, 2010, p. 261).
provision in the United States are extremely localized. There is no national curriculum at the primary- and secondary-levels in the United States (unlike in Norway, Finland, and South Korea), and the federal government plays only a minor role in funding and directing education (Books, 2004, p. 86; Heller, 2009, pp. 4–5; Mccluskey, 2010, p. 16; U.S. Department of Education, International Affairs Office, 2004, p. 5).

This arrangement is far less equitable than that in Norway, where the federal government provides all education funds in the form of block grants that are distributed by local governments (Boarini, 2009, p. 6; Opheim, 2004, p. 16). Given that American schools have widely varying resources, it is not surprising that test scores vary substantially according to socio-economic status in the U.S. (Friedman, 2012, p. 117; OECD, 2011c, p. 34; Ravitch, 2012). In Norway, in contrast, there is some evidence that first-generation immigrant students lag behind Norwegian-born students (Nusche, Earl, Maxwell, & Shewbridge, 2011, p. 128; OECD, 2011c, p. 61), but generally there are only small differences in achievement across Norwegian schools and among students from different socio-economic backgrounds (Nusche et al., 2011, p. 128).

Finally, education in both Norway and the United States is hampered by the poor quality of their teachers, who all too often have little or no qualification in the subjects they teach (Boarini, 2009, p. 20; Lyng & Blichfeldt, 2003, p. 42; OECD, 2011c, pp. 12, 67; Sowell, 1993, p. 25; U.S. Department of Education, International Affairs Office 2004, p. 19). Low admissions standards for entry into teacher education programs, which are noted for their lack of rigor and academic esteem, contribute to this (Auguste et al., 2010, pp. 5, 12–14; Boarini, 2009, pp. 21, 23). Moreover, in the United States, there is little consensus regarding the optimal curriculum for teacher education programs and the minimum standards for certification, which differ substantially from state to state (Michelli & Earley, 2011, p. 1; U.S. Department of Education and Office of Special Education and Rehabilitative Services 2008, p. 14).

It is somewhat easier to identify possible sources of high education costs in Norway and the United States—namely, inefficient spending practices (Boarini, 2009, p. 18; Friedman, 2012, p. 109). In Norway, this is driven mainly by the high costs of paying teachers to staff its many rural schools, with their unusually small class sizes (Boarini, 2009, p. 16; Lauglo, 1995, p. 269; Norwegian Directorate for Education and Training, 2012, p. 28). Meanwhile, in the United States non-educator expenses—for instance, salaries for teachers’ aides and school administrators, as well as the costs of bus transportation, sports programs, and school lunches—are unusually high (Auguste et al., 2010, p. 41; Dillon, 2011; Friedman, 2012, p. 116; OECD, 2011c, p. 28). Moreover, as already noted, spending (both public and private) on higher education is also extremely high in the United States, relative to most other OECD countries (OECD, 2012a, p. 7).

5.3. What we can learn from these four-country comparisons

Our study of educational practices in the United States, Finland, South Korea, and Norway identified several education arrangements and procedures that constitute promising models for the United States. Finland and South Korea’s focus on recruiting and training excellent teachers, for instance, arguably has contributed significantly to their students’ success at the primary and secondary levels of education (Barber & Moursched, 2007; OECD, 2010, p. 129). Well-trained teachers can spot struggling students before they fall behind and adjust their teaching methods to accommodate different students’ needs (OECD, 2010, p. 125; Ravitch, 2011). Moreover, Finland’s efficient spending practices and egalitarian, social welfare approach to education funding and provision treats “education... as an instrument to even out social inequality” (Partanen, 2011)—and seems to succeed. Fifteen-year-old Finns earn top scores on international assessments, with only small differences in scores among students in different locations and from different socio-economic backgrounds (Sahlberg, 2010, p. 46).

Finally, our research also identified education strategies that remain popular, but yield dubious results. For instance, Norway has some of the smallest class sizes in the world (class sizes in the United States are also comparatively small), while South Korea’s classes are among the largest (OECD and Pearson Foundation, 2010). Yet, South Korean students continue to surpass Norwegian and American students on international assessments. Thus, it seems reasonable to conclude that small class sizes do not necessarily improve student performance. In addition, Finland’s moderate teacher salaries call into question the use of large financial incentives to recruit and maintain a strong, intellectually excellent corps of teachers (OECD, 2010, p. 129).

Several other key points, noted next, also emerged from our multi-country research and analysis:

- At the primary and secondary levels of education, equity and consistency among schools (e.g., the Finnish “social welfare” approach to equitably funding schools [OECD, 2010, p. 123; Sahlberg, 2010, p. 48]), rather than the property tax-based American model, which enhances socio-economic inequalities in education [OECD, 2011b, p. 34]) seem to be effective. In contrast, in higher education competition and diversity of options (e.g., the American “free-market” approach to education [Bok, 2006, p. 27; Bowen, Kurzweil, & Tobin, 2005, p. 248; Economist, 2005]), in which many different types of schools compete to attract students, have proven to be most effective.

- Curriculum must achieve a careful balance between allowing for open inquiry and providing adequate structure. Finland and Norway, where national curricula guidelines are flexible but well-defined (Finnish National School Board, 2012; Nusche et al., 2011, p. 127; OECD, 2011c, p. 71; “Education”), exemplify this balance. In contrast, South Korea’s top-down, rigid curriculum (Adams & Gottlieb, 1993, p. 214), and America’s failure to define a national curriculum (U.S. Department of Education, International Affairs Office 2004, p. 5; U.S. Department of Education and Office of Special Education and Rehabilitative Services 2008, p. 9) represent two opposing extremes. However, these are matters of
overall educational policy, which are beyond the scope of this inquiry.

• Finland’s rejection of standardized testing and school inspections (Abrams, 2011; Sahlberg, 2010, p. 126) calls into question the effectiveness of using scores on standardized tests as the basis for determining teacher salaries and school funding, as in the United States (OECD, 2011b, 51–52, Fig. 2.14; U.S. Department of Education International Affairs Office, 2004, p. 55).

5.4. The value of specialization in education

It may be helpful to think of education as something akin to innovation. For instance, we know that a substantial share of the more revolutionary innovations has emerged from smaller and younger enterprises, rather than from larger, more established firms, with their well-equipped and organized research and development (R&D) divisions. Yet, large enterprises provide the bulk of financial investment in R&D activities in the United States, as well as a large share of employment opportunities for scientists and engineers with advanced levels of education. Clearly, both small and large firms play important roles in the innovation process. Similarly, routine research, which typically yields incremental improvements to currently available technology, requires relatively advanced educational mastery of known facts. In contrast, more revolutionary advances call for effective utilization of imagination and creativity, and consequently require a different educational orientation that embraces skepticism and novel ideas.

In much of the world, the essential goal of education is mastery of established knowledge, yielding great technical competence in dealing with tasks that are more or less standard. In the United States, however, education—especially at the tertiary level—encourages students to challenge existing knowledge and propose new ideas and analytic processes. Thus, it is possible for the United States to possess arguably the finest system of higher education in the world, even as the performance of American students at the primary and secondary levels is persistently mediocre. In contrast, other countries—South Korea and Finland, for instance—excel at the efficient provision of primary and secondary education that focuses on mastery of “known facts,” even as they struggle to provide world-class higher education (Seth, 2002, p. 243). Like small and large firms that make different, but equally important, contributions to the economy (incremental vs. break-through innovations), different countries excel in the provision of different types of education: mastery of known facts vs. training for novel exploration. We contend that these bifurcated, but complementary, approaches to education (and innovation) together provide significant benefits to society.

6. Technology to combat the cost disease: is it possible to reduce education expenditures without undermining quality?

In this study we have focused on the cost disease as a prime contributor to the universally rising costs of education. Elsewhere, in discussions of other economic activities burdened by the cost disease—notably in the analysis of the costs of health care in Baumol, Batey Blackman, and Wolff (2012), the difficulty of achieving significant reductions in the rate of cost increases and the threat to the quality of health care that attempts to achieve cost savings sometimes entail has been emphasized. However, there are reasons to believe that the financing and provision of education are rather different. Not only are significant savings possible via new technology, but also substantial effort is already underway to make some of these changes. However, we do not yet know if these technology-based approaches (some of which are essentially multimedia “textbooks” that students use to teach themselves, with minimal direct guidance from professors) will yield educational results that match those of current educational methods. Moreover, it’s not clear if online learning promises a one-time reduction in cost, or if it offers a future in which rising costs can be significantly constrained, if not eliminated altogether, in the longer term.

The Internet and the other technological breakthroughs that provide rapid communication across great distances are the source of most of these savings. As a result, a professor in a classroom in California can now deliver her lecture via streaming video to hundreds of thousands of students throughout the world, by use of the Internet. Moreover, exams and coursework can be assigned and completed over the Internet, and students and professors can share ideas and questions efficiently, via interactive online discussion boards and social media applications. MIT’s OpenCourseWare was one of the first and most visible online learning efforts. However, “Massive Open Online Courses” (MOOCs) at dozens of American universities and a handful of high-profile online learning initiatives—for instance, Coursera, Udacity, and edX—now offer free access to auto-graded quizzes and online discussion forums, in addition to taped lectures and other course materials created by experts at leading universities (Bowen, 2013, p. 74; Harden, 2013). More than five million students worldwide have registered for these Web-based “open courses” (Jacobs, 2013).

Most of these do not offer academic credit, but edX (at Harvard and MIT) and Western Governors University offer “certificates of mastery” to students who complete online courses and pass tests on course material (Harden, 2013; Stokes, 2011, p. 218). StraighterLine, though not affiliated with a prestigious university, does offer online general education courses with college credits for modest monthly and per-course fees (Stokes, 2011, p. 218). Notably, Carnegie Mellon’s Open Learning Initiative, which builds interactive online courses designed by multi-disciplinary teams of cognitive psychologists, software engineers, and discipline experts, is developing sophisticated online courses that guide students through new content and provide detailed feedback to instructor. These allow an instructor to track individual students’ outcomes in a

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course and then determine the effectiveness of particular portions of a course.

The opportunity the Internet offers for financial savings in this arena should be obvious. According to Stokes (2011), for-profit universities—early leaders in online learning (200)—are already realizing significant reductions in their overall costs, resulting from lower operations costs and smaller investments in physical facilities and other amenities (215). Moreover, as Harden (2013) points out, community colleges, which educate large and ever-growing percentages of Americans (Osterman, 2011, p. 129), could improve their curriculum at little additional cost by taking advantage of MOOCs created by experts at elite universities. Online technologies also could help to increase the pace at which students get through the educational system (Bowen, 2013, p. 54), allowing ambitious high school students to get a head start on introductory-level college courses (Bowen, 2013, p. 54) and current college to benefit from easier access to courses they need for graduation (Bowen, 2013, p. 16). Finally, Stokes (2011) reports the results of an experimental grant program administered by the National Center for Course Transformation (NCAT), in which grants of $200,000 were offered to 30 higher education institutions to fund the incorporation of online learning techniques in existing courses. According to the NCAT, participating schools realized average cost savings of 37 percent as a result of the use of new technology in their courses (Stokes, 2011, p. 212).

The effectiveness of such online instructional approaches and their effects on the quality of students’ learning outcomes are already being tested by researchers. So far, the results are promising, but inconclusive. Perhaps the best of these is a study by ITHAKA26 of a “hybrid-online” course created by Carnegie Mellon University’s Open Learning Initiative. The hybrid-online version of the course, which combines minimal classroom contact with interactive online instruction (designed by teams of cognitive scientists, software engineers, and discipline specialists at Carnegie Mellon), was administered at several public universities in New York State and Maryland. ITHAKA researchers compared outcomes for students taking a traditional (i.e., offline) version of the course with outcomes for students in the hybrid-online course and found no statistically significant differences between the two groups (Bowen, 2013, p. 48). Researchers concluded that students who received computer instruction learned “the same amount of material in 25 percent less time” (Harden, 2013). Moreover, that finding held true across all the campuses involved in the study and for all demographic groups among the diverse student body (Bowen, 2013, p. 49).

Stokes (2011) also reports the results of a “meta-analysis” of earlier studies on the quality of online learning vs. traditional classroom learning, performed by the U.S. Department of Education in 2009. That study found that, on average, students who took all, or part, of a course online performed better than those who received traditional face-to-face instruction (Stokes, 2011, p. 210).27 The same study concluded that “hybrid” instruction combining online and face-to-face instruction had even better outcomes, relative to traditional classroom teaching, than “purely online” instruction (Stokes, 2011, p. 211). Of course, analogous opportunities for cost saving along with enhanced effectiveness also can be implemented at earlier stages in the education process. For example, Khan Academy’s free online videos and computer-based instructional modules are already in widespread use at the secondary level (Bowen, 2013, pp. 74–75).

Still, a number of significant questions about these new instructional methods must be studied and tested further, in order to identify their advantages and disadvantages. For instance, other researchers find that community college students enrolled in online courses are more likely to fail or drop out of an online course than those receiving classroom-based instruction (Xu & Jaggars, 2011).28 Similarly, a recent study estimated that the average completion rate for MOOCs is less than seven percent (Parr, 2013). In addition, a New York Times reporter who spent a semester taking MOOCs offered by Coursera, edX, and Udacity, complained that it was nearly impossible interact with professors and reported that cheating and high dropout rates were common in his courses (Jacobs, 2013).

Moreover, it is not yet clear how online instruction affects the learning and career opportunities of those student participants who are not physically connected with a sponsoring university. Moreover, as Bowen (2013) points out, researchers and educators have only a very limited understanding of how Massive Online Open Courses (MOOCs) can produce good learning outcomes (61) and become financially viable for universities, who must maintain and upgrade the online systems that deliver course content (60).

Reservations about this new educational approach are understandable. However, it is also possible that it will enable more students to receive instruction from professors who are the most gifted communicators and most effective teachers. After all, a live-streamed lecture by an extraordinarily talented teacher may provide better instruction than the same material presented live by a local professor who is a mediocre expositor.29 Meanwhile, large numbers of academics could be freed to focus on research and writing, rather than teaching (Harden, 2013).

25 As of fall 2008, community colleges accounted for 43 percent of all post-secondary enrollment. Between 1963 and 2006, enrollment in community colleges increased by 741 percent; during that time period, enrollment at public four-year colleges and universities grew by just 197 percent and at private four-year colleges and universities by 170 percent (Osterman, 2011, p. 129).

26 Note that ITHAKA is a non-profit organization that seeks to advance the use of digital technologies in teaching and research.

27 However, critics of the Department of Education study point out that the results do not hold for courses conducted fully online (i.e., not hybrids) over the course of an entire semester (Jaggars & Bailey, 2010).

28 See also Xu & Jaggars (2011) in this journal.

29 Alternatively, as Jacobs (2013) argues, “MOOCs are a great unequalizer when it comes to teachers. MOOCs are creating a breed of A-list celebrity professors who have lopsided sway over the landscape of ideas”.

21 As of fall 2008, community colleges accounted for 43 percent of all post-secondary enrollment. Between 1963 and 2006, enrollment in community colleges increased by 741 percent; during that time period, enrollment at public four-year colleges and universities grew by just 197 percent and at private four-year colleges and universities by 170 percent (Osterman, 2011, p. 129).

26 Note that ITHAKA is a non-profit organization that seeks to advance the use of digital technologies in teaching and research.
For instance, in the future a few “select” online education organizations may create and distribute video lectures and other course materials, which local professors will use as the basis for in-class discussion and ancillary instruction. Finally, both professors and students in MOOCs can benefit from contact with far more diverse student populations, which include “millions of people around the globe with few resources” who otherwise would not be able to access elite university educations (Jacobs, 2013). Thus, the Internet may be a “great equalizer” (Harden, 2013), enabling a few exceptionally gifted professors to reach a much larger group of students without imposing significant additional costs.

But are such productivity increases enough to offset the rising costs of education? Bowen (2013) concludes that it is not:

“[l]s online learning a fix for the cost disease? My answer: no, not by itself. But it can be part of an answer.
... I continue to believe that the potential for online learning to help reduce costs without adversely affecting educational outcomes is very real” (70 and 63).

Similarly, Stokes (2011) is cautiously optimistic, noting that, in the future, best practices for higher education may take a hybrid approach, “[combining] the best elements of the traditional classroom with the innovations of online learning” (224).

We agree that such technology-based innovations in higher education can be expected to increase classroom efficiency and, thereby, provide savings.30 Moreover, current research indicates that such educational innovations seem to constitute little threat to the quality of teaching and conceivably may even improve it. In other words, it is possible to constrain the rising costs of education without damaging its quality—and perhaps even enhancing it. However, we urge that such important matters should not be settled hastily. Rather, we agree with Bowen (2013) that further analysis of solid evidence will be indispensable to establishing a fuller understanding of such new educational approaches (71).

In addition, we foresee that these new educational technologies may well contribute a large, one-time boost to productivity (and cost reduction) in education. However, in the long term, they may offer relatively little opportunity for additional, ongoing cost savings. For example, after a school has established the necessary infrastructure to deliver online lectures and discussion—thereby reducing spending on physical facilities and human instructors, there may be little opportunity for further cost saving by such means. Thus, these new educational technologies may yield a significant, one-time reduction in education spending, but may contribute very little to slowing ever-rising education costs over the long term.

7. Conclusions: yes, we can afford education

Our analysis of relevant cost data suggests that education spending will increase enormously in the next century. But despite the great and unrelenting increase in education costs, the amount left over for all other purchases also will grow substantially thanks to ever-rising income and productivity in the United States. We will be so much richer overall that, despite dramatically increasing education costs, we will be able to afford much more of everything. The cost disease turns out to affect only the way we divide up the money we spend and does not force us to decrease how much we buy. Thus, even if there is no increase in the work we expend, our standard of living will have improved dramatically.

Clearly there is reason for optimism. With productivity rising almost everywhere—in some industries more slowly, in others more rapidly—all industries must be growing less costly in the amount of human labor they require. Thus, no matter how painful rising education (and medical) bills may be, society can afford them. Overall incomes and purchasing power must rise quickly enough to keep these services affordable, despite their persistently rising costs.

But suppose the future does not bring ever growing productivity. Suppose innovation grinds to a halt, we run out of natural resources, and average income levels cease their steady rise. Then what? The cost disease, too, will terminate because it stems from unequal rates of productivity growth in different sectors of the economy. If productivity growth is zero in all areas of the economy, these inequalities will disappear. The cost disease would no longer be any part of the problem, but that’s the only good news: our problems—particularly poverty—would be far worse.

The picture that emerges is not so daunting. We can have it all: good education, better health care, and even more orchestral performances. In exchange, we will not have to surrender food, clothing, shelter, or even less essential commodities such as comfortable vacations, unrestricted travel, and readily available entertainment. This is not merely naïve optimism but something we have already experienced. The galloping college tuition increases and exploding cost of hospital care since World War II have not prevented us from consuming these and other services and goods. Indeed, a continually rising share of the population attends college and we now live longer than ever. After all, if productivity is rising everywhere—even if it is slower in some industries than in others—then, by definition, the same or even fewer hours of labor will produce more of all goods and services than before.

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References
