STRETCHING THE HIGHER EDUCATION DOLLAR

AMERICAN ENTERPRISE INSTITUTE

SPECIAL REPORT 2

Addressing the Declining Productivity of Higher Education Using Cost-Effectiveness Analysis

Douglas N. Harris | April 2013

Preface

The recent fiscal crisis has brought American higher education to a watershed moment. After decades of expansive growth in enrollments and spending, state budget cuts and damaged endowments have driven double-digit increases in tuition over the past decade. In the wake of significant increases in federal student aid over the past four years, a growing federal deficit suggests that aid programs will be hard-pressed to keep up with the growth in tuition prices. Meanwhile, lackluster employment outcomes for recent college graduates and ballooning student loan debt have created an increasing sense of disillusionment among policymakers and the public alike. More than ever, Americans are questioning whether a college degree is worth the cost of admission.

For their part, most colleges and universities have been reticent to rethink their cost structure—that is, what it actually costs to provide the education they deliver—in light of these fiscal challenges. Instead, they have typically chosen to raise tuition, cut course offerings, even close the door to qualified, tuition-paying students. In an era of declining public support and trust, battening down the hatches and waiting for sunnier days is not a recipe for regaining public confidence, let alone meeting our human-capital needs.

But the future is not as bleak as it may seem. The stark fiscal challenges facing governments and endowments are forcing forward-thinking higher education leaders and entrepreneurs to reconsider the traditional model and to propose new, lower-cost modes of delivery and credentialing, arguments that resonate less during boom times. The prospect of reinventing higher education through online learning, long dismissed as being of low quality, has been renewed with the emergence of massive open online courses, some of which bear the imprimatur of elite universities.

Elsewhere, some institutions and systems are experimenting with ways for students to earn their degrees more quickly and at a lower price. Even President Obama has chimed in, famously declaring in his 2012 State of the Union address, “Let me put colleges and universities on notice: if you can’t stop tuition from going up, the funding you get from taxpayers will go down.”

To make sense of these developments, AEI’s Education Policy Studies department, along with Kevin Carey of the New America Foundation, commissioned new research from leading academics, journalists, and entrepreneurs on how to do more with less in higher education. The collection of essays was first presented at an August 2012 research conference entitled “Stretching the Higher Education Dollar.” You can find conference drafts of the papers online at www.aei.org/events/2012/08/02/stretching-the-higher-education-dollar/. A revised set of those papers will be released as an edited volume from Harvard Education Press in summer 2013.

This forthcoming volume does a superb job of identifying the barriers to cost containment and the opportunities to fundamentally redefine the cost structure of higher education in the future. But after conversations with stakeholders across the country, we also recognized an appetite for concrete, near-term steps that policymakers and leaders can take to help get control of college costs, as well as clearer data on how higher education revenue and spending have changed over time. To help satisfy these needs, we commissioned three new pieces of research.

In “Initiatives for Containing the Cost of Higher Education,” William F. Massy, professor emeritus and former vice president for business and finance at Stanford University, offers a comprehensive reform agenda for policymakers interested in cost containment. Massy lays out a series of initiatives that, working in tandem, can promote the larger goal of compelling colleges to spend money wisely. Among the individual reforms Massy proposes are creating a national database of cost-containment practices, a “Race to the Top” for college productivity, and process audits for all public institutions. The primary aim, Massy contends, is to help provide the necessary information for a vibrant higher education market in a way that current policymakers and college leaders can get behind.

In "Addressing the Declining Productivity of Higher Education Using Cost-Effectiveness Analysis," Douglas N. Harris, associate professor of economics and university endowed chair in public education at Tulane University, takes a rigorous, empirical look at the cost-effectiveness of popular higher education policies and programs. Harris argues that policymakers and school leaders have far more control over productivity than assumed, but tend to lack the requisite information on which strategies will be most productive. Running through an array of these programs and policies—from class-size reductions, to various financial aid programs, to student services—Harris provides a framework that can help college leaders determine which policies and practices provide the most bang for our higher education buck.

Finally, in "Public Policies, Prices, and Productivity in American Higher Education," public policy consultant Arthur M. Hauptman examines the impact of federal and state policies on the escalating costs and diminishing productivity of higher education. After a brief overview of trends over the past 40 years in college tuitions and spending, Hauptman offers a series of suggestions for federal and state policy reforms. Among these are restricting the use of private student loans, pegging tuition at public institutions to a general measure of a family's ability to pay (such as median family income), and rethinking funding formulas to invest more in lower-cost public institutions like community colleges.

We are excited to release these three papers as the concluding part of our Stretching the Higher Education Dollar series. Although the ideas in each are certainly open to discussion, we hope they present an informative and provocative set of actionable recommendations for policymakers and college leaders. For further information on the papers, or with any questions, please visit www.aei.org/policy/education/ or contact Daniel Lautzenheiser at daniel.lautzenheiser@aei.org.

—Andrew P. Kelly
Research Fellow, Education Policy Studies
American Enterprise Institute

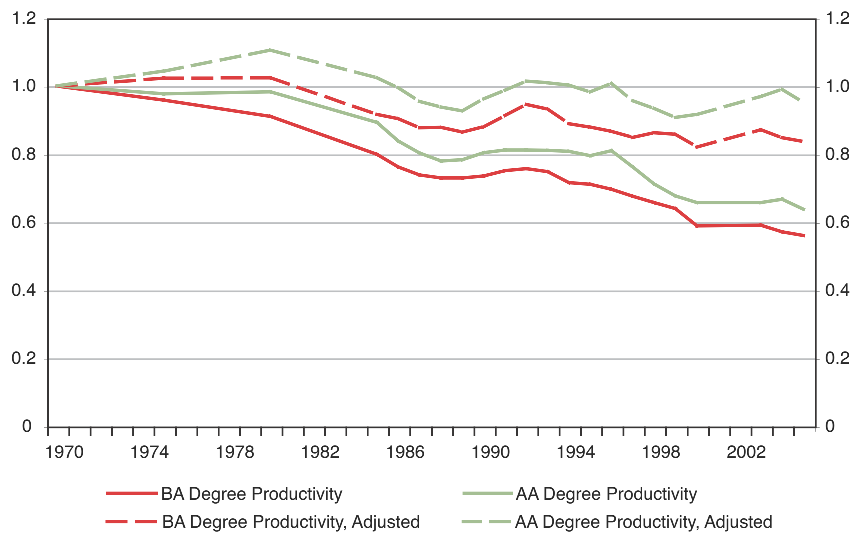
Addressing the Declining Productivity of Higher Education Using Cost-Effectiveness Analysis

Douglas N. Harris

Higher education productivity, as measured by academic degrees granted by American colleges and universities, is declining.[1] Since the early 1990s, real expenditures on higher education have grown by more than 25 percent, now amounting to 2.9 percent of US gross domestic product (GDP)—greater than the percentage of GDP spent on higher education in almost any of the other developed countries.[2] But while the proportion of high-school graduates going on to college has risen dramatically, the percentage of entering college students *finishing* a bachelor's degree has at best increased only slightly or, at worst, has declined.[3]

Figure 1 shows the trend in productivity from 1970 to 2006, expressed in terms of the ratio of degrees granted to total sector expenditures.[4] The downward slope is steepest among universities, where current productivity is less than half of what it was 40 years ago. Even when adjusted for the growth in overall labor costs in the economy (see dashed lines in figure 1), the decline in bachelor's-degree production is nearly 20 percent. If these declines continue, maintaining the current rate of bachelor's-degree production will cost an additional $42 billion per year 40 years from now.[5] Thus, even if state support for public higher education did not continue to decline, tuition would have to increase by an average of $6,885 per full-time equivalent (FTE) student in public universities to maintain current spending, almost doubling today's tuition.[6]

FIGURE 1
THE PRODUCTIVITY DECLINE, 1970–2006 (RATIO OF DEGREES TO EXPENDITURES IN PUBLIC COLLEGES, BASE YEAR=1970)



Source: National Center for Education Statistics, *Digest of Education Statistics* (1970–2006).
Note: Expenditure data were not available beyond 2001, and therefore revenue data were used in their place. Expenditure data are in real (inflation-adjusted) 2006 dollars. Data were available only every five years during the 1970s; the intervening years are interpolated. Data on private colleges is only sporadically available and therefore excluded.

What accounts for declining productivity in higher education? Prior research provides an array of potential explanations.[7] Most analysts point to the role of rising costs, and others focus on declining degree attainment.[8] Collectively, these explanations reinforce a widespread perception among higher education administrators and many scholars that productivity is impossible to control. According to economists Robert B. Archibald and David H. Feldman, "The problem in higher education is that productivity growth often is synonymous with lower quality. Adding more students to each class can diminish the benefit for each student, leading to diminished outcomes and lower graduation rates. Increasing the number of courses a professor teaches would reduce research or community service."[9] Similarly, in a study of college presidents' attitudes, a two-year president said: "I don't think there are any more efficiencies left to be squeezed out of public universities across the nation. . . . There are

Douglas N. Harris is an associate professor of economics and the university-endowed chair in public education at Tulane University.

no more efficiencies to be had."[10] So, at least some institutional leaders feel helpless when it comes to improving productivity without sacrificing quality.[11] Even when costs are considered, institutions tend to focus on enrolling more students rather than helping them graduate.[12]

In this paper, I show that policymakers and college leaders do in fact have some control over productivity, but generally lack the information necessary to take the appropriate steps toward improvement. Specifically, decision makers have little information about which programs, policies, and resource decisions are most cost-effective. Relative to other areas of public policy, cost-effectiveness analysis is rarely applied to specific education policies and programs.[13] Even research that looks at the higher education system as a whole rarely considers the relationship between the costs and output—that is, productivity.[14]

Cost-effectiveness analysis cannot and should not replace the judgment of educational leaders, but the information that comes from it can provide useful guidance and perhaps improve the way those decisions are made.

A basic principle of decision making is that we have to compare the costs and benefits of all feasible options, but this rarely happens in analyses of higher education. Even those few studies that do consider cost-effectiveness do not attempt to compare across programs. This absence is hard to justify because there is little question that—as my analysis later in this paper shows—some programs are much more cost-effective than others. In addition, cost-effectiveness analyses often ignore the practical constraints of decision makers, such as the availability of state or federal matching grants and pressures to boost college rankings. This paper tries to avoid that problem by addressing the distinctive features of higher education and laying out key questions policymakers need to ask themselves when interpreting the results of cost-effectiveness analyses.

After outlining a method for applying cost-effectiveness analysis to higher education, I apply the approach to a variety of well-known programs, ranging from financial aid to student services and alternative modes of instruction. Although the estimates that come out of this analysis may be useful by themselves, the main aim of this paper is to highlight a different way of thinking about the decisions policymakers and college leaders face and provide a concrete way forward that can help reverse declining productivity. Cost-effectiveness analysis cannot and should not replace the judgment of educational leaders, but the information that comes from it can provide useful guidance and perhaps improve the way those decisions are made.

Basic Elements of Cost-Effectiveness Analysis for Higher Education

Cost-effectiveness analysis may sound like a complicated academic concept, but the truth is that we use this type of thinking in our daily lives. When buying a car, many people look at ratings in *Consumer Reports*, for example, to find information about the "best values." This analysis is just another way of saying the cars are good, given what you have to pay—that is, they are cost-effective and have a large "bang for the buck." This kind of cost-effectiveness analysis is not to say that the approach is simple. Not everyone would agree on what cars represent the best value because different people prefer different types of cars and have different driving needs. But it is a useful way to think about and make choices. Given how common this mode of thinking is, it is striking that cost-effectiveness analysis is often absent in higher education. As leaders come under increasing pressure to maintain or improve student outcomes in times of tight budgets, they are likely to find this kind of analysis not only useful, but necessary.

Calculating and Standardizing Effectiveness-Cost and Benefit-Cost Ratios. The primary metric for understanding the relationship between program costs and their effects is the effectiveness-cost ratio (ECR). The first component of the ratio is the cost of a given policy or program, measured by the "market price" of the various components such as the salary and benefits of staff involved in the program and the cost of maintaining or expanding facilities necessary to implement it.[15]

Unfortunately, data on higher education costs are notoriously incomplete, and remarkably few studies of particular higher education interventions report the resources or "ingredients" involved or the prices that have to be paid for them. For this reason, in my analysis of well-known college programs, I often had to estimate them myself by making informed assumptions. For example, most publicly available descriptions of programs provide a general sense of the number and type of staff involved in programs. To estimate total costs, I started with this information and then used nationally representative data on the salaries of workers in similar occupations and professions. Going forward, policymakers and institutional leaders should insist on and collect granular measurements of cost to assess cost-effectiveness.

Decision makers also need to know whether the programs they are spending money on are effective. But in what sense do they need to be effective? Policy and research have traditionally focused on providing access to higher education, though the new "completion agenda" has drawn attention to measures of student success (retention, credit accumulation, and degree completion). I focus my analysis on degree completion because this outcome aligns with goals of students, policymakers, and, increasingly, institutional leaders. We need to recognize, however, that focusing on a single outcome such as degrees may reinforce a trend toward narrowing the functions of education only to those that we measure. The practical implication is that, in using this evidence to make policy decisions, we need to account for potential tradeoffs among multiple outcomes—degree completion and degree quality, for example—in a more qualitative manner, with more rigorous evidence for some outcomes than others.

A second issue is that it can be very difficult to know whether a given program really generates effects. Higher education research often relies on simple correlations; for example, students enrolled in a given program were more likely to graduate than the average or apparently similar students. But correlation is not causation. For example, does anyone really think that Harvard University has a high graduation rate because its programs cause students to do better? Of course not. Those students graduate because they had exceptional abilities, motivation, and other such qualities before they got to Harvard. Conversely, colleges and programs should not be punished because they serve students who are less likely to graduate—if anything, they should be rewarded and praised for it. For this reason, educational leaders should try to identify studies that use more rigorous methods, such as randomized trials and "natural experiments" where outcomes are compared before and after a program or policy started. (College leaders can even conduct some of this research themselves using their own faculties and well-trained institutional researchers. I will discuss this in more detail later.)

Once we have credible estimates of costs and effects, we can combine them to calculate the ECR, or "bang" divided by "buck." A standard metric in economic analysis is that larger ECRs generally imply greater productivity.[16] With an outcome such as graduation rate, it is intuitive to standardize program costs for an entering cohort of 100 students. This means that the costs also have to be calculated for the whole group. For example, consider a program that costs $500 per student, or $50,000 for a group of 100 students. If the same program increases the graduation rate by one person (per 100), then the ECR is 1 divided by 50, which equals 0.02. (The denominator of 50 represents the $50,000 in costs expressed in thousands of dollars so as to avoid extremely small numbers like 0.00002.)

A key strength of ECRs is that they express outcomes in easily digestible terms. Degrees and costs are ideas that educational leaders can easily grasp.[17] When calculated in comparable ways, ECRs can also be used to make comparisons across programs, so we can say whether one program is more cost-effective than another. With a fixed pot of money, this approach helps allocate resources in ways that generate the best results for students.

Economists often take this type of analysis a step further by calculating the monetary value of effects. In higher education, the most prominent example of monetary value is the earnings of graduates. The economic return to a degree, measured by increased earnings, is approximately $387,000 for a four-year degree ($282,000 for a two-year degree), excluding other social benefits.[18] Thus, as long as these benefit estimates exceed the discounted costs of producing a degree, the program passes a cost-benefit test, and the program is said to be "profitable" from a societal standpoint. The advantage of this approach is that it allows not only comparisons among programs, but also more absolute judgments—regardless of whether there is a positive payoff. This is especially important when policymakers are considering adding resources to the system. The disadvantage of the approach is that the narrow focus on degrees is compounded by the additional focus on earnings. Understandably, educators are often leery of trying to place a dollar value on learning. For this reason, and to concentrate attention on the potential power of cost-effectiveness, I focus only on ECRs. A more extensive and technical version of this analysis is available in another paper.[19]

Placing ECRs on a Level Playing Field. The goal is to create effectiveness-cost ratios that can be reasonably compared across programs. A key challenge is that, even among those relatively few studies using rigorous methods, different studies focus on different outcomes, requiring some type of conversion to a common metric. In higher education research, analysts commonly report effects on college entry and persistence only, rather than the primary outcome of interest—graduation. To place the estimates on a level playing field, I had to translate estimates of persistence effects into graduation effects using data and other research on the relationship between entry, persistence, and graduation. Because entry and persistence are prerequisites to graduation, a plausible range of estimates can be made this way.[20]

> As leaders come under increasing pressure to maintain or improve student outcomes in times of tight budgets, they are likely to find cost-effectiveness analysis not only useful, but necessary.

The same goes for costs. Some programs last only one year, whereas others go for many years. Some of the longer-term programs have high attrition, so fewer students are served in later years; this affects the cost per student. Therefore, although I start by reporting costs in annual terms, the final calculations account for the number of years the average student participates in the program.

Obviously many steps are involved in this analysis, and many assumptions are made along the way. I had to make some educated guesses about costs using public information and general market process. I also had to translate effects on entry and persistence into graduation and, in some cases, estimate how long the average student stays in a program. To provide some sense of the potential ranges for the ratios, I therefore report lower and upper bounds that account for some of the uncertainty.

But the fact that these bounds are necessary presents another argument for college leaders to engage in their own rigorous experimentation. They have the data to track their own students' outcomes, including degrees. They could also collect detailed cost data with a little more effort. And they could carry out their own experiments and pilot studies to determine what seems most cost-effective in their own institutions with their specific students and their possibly distinctive needs. These more local efforts can complement the more expensive and rigorous studies funded by the federal government that are becoming somewhat more common but remain rare. College leaders do not need to wait for some miracle "cure" to arise from some national study when they have needs and resources of their own with which to work.

Comparing ECRs: Challenges and Practical Questions. Even if there were no uncertainty in these calculations, policymakers would still have to be cautious about blindly adopting the programs with the largest ECRs. Specifically, decision makers in higher education should ask themselves the following questions:

- What outcomes did the study measure, and therefore, how confident are we that the results translate to increased graduation?
- How might the program affect quality?
- Are we likely to see the same results if we implement the program in my state or institution?

The answers to these questions establish the degree to which a given cost-effectiveness analysis is even relevant for a given decision. For example, a study that suggests large effects on the number of graduates is not very helpful if evidence also indicates substantial reductions in academic rigor. This might be a problem, for example, with a program that allows students to finish degrees more quickly. Or a study might examine effects on grade point average (GPA), but it is unclear how GPA translates to the desired outcome, such as graduation.

Even if the answers to these basic questions suggest that a study is relevant to a given decision, other questions about the local context have to be considered. The answers to the questions below will affect the likelihood that the outcomes of the study will translate to a particular college or state:

- Given the various funding streams and political constraints, what are my truly viable options?
- Are certain elements of these alternatives likely to be especially costly in my situation? (For example, programs that require physical infrastructure might be more costly in urban campuses.)

- Are there secondary effects of the programs that are not reflected in the calculations? (State policymakers might worry, for instance, that financial aid generates budgetary costs and induces colleges to further raise tuition. Conversely, many people think of financial aid as part of a larger social contract, making cost-effectiveness a smaller consideration.)

- Also, might it be possible to obtain third-party funding for some of the alternatives but not others? (Institutions may sometimes be able to find matching funds to reduce costs below what the cost-effectiveness analysis assumes. Likewise, state governments can seek funds from the federal government. More generally, although cost-effectiveness analysis treats all dollars the same, all dollars are not created equal among policymakers.)

Finally, some leaders I have spoken with about the cost-effectiveness approach wonder about the usefulness of comparing different types of programs. Specifically, three different types of comparisons exist: (1) comparisons across strategies (for example, instructional improvement versus financial aid); (2) comparisons across programs within strategies (for example, improving instruction through smaller classes versus instructional technology); and (3) comparisons within strategies but across student populations. I argue that the first two comparisons are important for improving productivity, whereas the third raises equity concerns that I discuss in greater detail later on.

Efficiency and Equity. The usual aim of cost-effectiveness analysis is to improve productivity and efficiency. But one of the central aims of education is to level the playing field in society so that everyone has a chance in life. This is one of the central arguments behind, for example, affirmative action programs in higher education.

Fortunately, cost-effectiveness analysis can be adapted to incorporate a broader notion of social welfare that includes equity. The first approach, which I call the subjective approach, involves separately analyzing programs and policies aimed at different groups and then making qualitative judgments about the best balance of outcomes for all groups. The advantage of this approach is that it explicitly addresses equity while recognizing that equity can mean different things to different people. Some educational leaders might be more concerned with the equity of outcomes while others might be more concerned with ensuring that all students have the same opportunities available.

Alternatively, the quantitative approach to equity gives numerical weight to the outcomes of groups whose success is of greatest concern. For example, I could multiply outcomes of disadvantaged student groups by a factor of two before summing across individuals. While this quantification imposes a strict definition of equity, it also reduces the likelihood that equity will be ignored in the final analysis. Numeric results are often taken at face value in policy deliberations, so handling equity subjectively can mean essentially ignoring the issue. As I discuss later, I use this simple mathematical approach in part of my analysis.

Applying the Framework: The Cost-Effectiveness of Well-Known Programs

To highlight the potential of the cost-effectiveness approach, I focus most of the remainder of this paper on applying the approach to a variety of higher education programs. This review is not meant to be comprehensive, but rather an illustration of the different ways that ECRs can be calculated and the issues that arise in the comparisons. I sought a range of programs that varied on the basis of strategy employed (financial, instructional, student service), quality of cost information and impact information available, level of required resources, institutional context (two-year versus four-year colleges), and student population (targeted to disadvantaged students or broadly available). I define "disadvantaged" students broadly to refer to those whose families have below-average income, though the precise income cutoffs for program eligibility vary somewhat across programs placed in this category.

Educators are often skeptical of economic reasoning in the context of program and resource decisions, raising concerns about "bean counters" who do not understand education and whose main goal is to do things cheaply. Therefore, I again emphasize that cost-effectiveness analysis identifies programs and policies that are not inexpensive per se, but inexpensive given the additional learning they produce. The analysis requires more than just counting costs and effects; it requires good answers to the questions posed earlier and in-depth knowledge of the institutional context, students served, and pedagogy.

Common Hallmarks of Higher Education Quality: Student-Faculty Ratios and Full-Time Faculty. I begin with two resource-allocation decisions that have important effects on budgets and are widely seen as key indicators of quality—student-faculty ratios and hiring of full-time faculty. Although much of the debate about higher education has moved beyond these resources, they still comprise 13 percent of *U.S. News and World Report*'s undergraduate rankings.[21] Here, I consider the costs of each, briefly summarize available evidence on impacts, and report ECRs using the previously explained methodology.

Student-Faculty Ratio and Class Size. For a given faculty teaching load, a small student-faculty ratio means small class sizes. Faculty-student interaction outside the classroom may also be facilitated this way. Daniel Jacoby reports full-time faculty salaries of $74,443 ($58,041) and part-time faculty salaries of $16,156 ($12,174).[22]

The current student-faculty ratio (full-time-equivalent basis) is 14.8 (19.2) for public institutions.[23] Four-year (two-year) colleges have two-thirds (one-third) of their courses taught by full-time faculty.[24] On the basis of these ratios and salaries (weighted appropriately by sector for the proportion of faculty who are part time and full time, and adding in fringe benefits), reducing the student-faculty ratio from 15 to 14 (from 19 to 18) would therefore cost $32,561 ($9,477) per year for 100 students, excluding capital costs and fringe benefits.[25]

On the effect side of the equation, I found several studies of class size and achievement, and these tend to suggest that smaller classes do yield more learning.[26] Because achievement effects cannot be readily translated into graduation rates, I rely on the recent work of economists John Bound, Michael Lovenheim, and Sarah Turner.[27] They find that reducing the student-faculty ratio by one increases degree completion by 1.11 (0.03) percentage points. The large differences between four-year and two-year results here are noteworthy. Although these results are based on fairly simple regression analyses, I do report the results because student-faculty ratio and class size are such important components of college costs. The adjusted ECR is 0.0083 (0.0015).

Full-Time Faculty and Adjuncts. One way colleges have attempted to reduce costs in recent decades is through hiring adjuncts or part-time faculty. I calculate the costs of this change on the basis of data on percent part-time and full-time faculty salaries, as well as the precise number of courses taught by part-time and full-time faculty.[28] The costs of switching from the actual proportions to all full-time faculty would be $205,742 ($257,674).

Ronald G. Ehrenberg and Liang Zhang estimate the effects of full-time faculty by comparing graduation rates and percent full-time faculty across time within colleges.[29] The results of this approach imply that reducing the percent part time by 1.00 percentage point would reduce the graduation rate by 0.14 percentage points. Multiplying this by 33 (the actual percent part time) implies that eliminating part-time faculty would increase the graduation rate by 4.6 percentage points. The authors do not report results for two-year colleges, but Jacoby does in his regression analysis: increasing the full-time faculty by 1.00 percentage point is associated with a rise in the graduation rate of 0.15 percentage points.[30] To move from 33 percent to 100 percent full-time faculty would therefore increase graduation rates by 10 percentage points.[31] The adjusted ECRs are 0.0055 (0.0181). The figure is much higher in the two-year sector because the effects appear larger and the costs smaller, compared with the four-year sector.

College leaders do not need to wait for some miracle "cure" to arise from some national study when they have needs and resources of their own with which to work.

College Access Programs. Policymakers have focused for decades on increasing access to higher education by targeting disadvantaged middle- and high-school students. Some of the oldest and most researched access programs are Upward Bound and Talent Search.

Upward Bound. One of the original federal TRIO programs aimed at increasing college access among low-income, first-generation students, Upward Bound provides tutoring and SAT and ACT test preparation, summer and after-school sessions aimed at improving language arts and math skills, and college campus visits. These regular interactions with students make Upward Bound more costly. Cohort cost estimates range from $480,000 to $516,000–$677,000.[32] The former and lower figure is based on federal budgetary contributions, and the higher figure range is based on opportunity costs in some specific sites, which reflects the general observation that budgetary costs understate total resources.

A randomized study of Upward Bound has yielded conflicting findings. One analysis by the organization that ran the experiment found no detectable effect on any college outcome, except for a 5 percentage-point increase in vocational certificates and licenses.[33] However, more recent analyses of the same data that Alan Nathan and I have examined suggest the estimated effects are very sensitive to the specific statistical techniques used and that the effects were likely positive for other high-school and college outcomes.[34]

Given the controversy over the estimates and the fact that the one area where the two analyses agree—effects on certificates and licenses—is considered less valuable than bachelor's degrees, I use 2 percentage points as the baseline impact for average low-income students.[35] This yields an adjusted ECR for average students of 0.0015.[36]

Talent Search. The second of the original federal TRIO programs (and the largest in terms of the number of students served), Talent Search provides a combination of academic support, career development activities, and financial aid assistance to high-school students.[37] Specific services include advice on test taking, study skills, academics, course selection, college orientation, college campus visits, referrals, counseling, financial aid counseling, and workshops. Federal contributions amounted to $392 per participant in 2009, which is considerably lower than other TRIO programs. The implied cohort cost is $39,200. With each of these college access programs, I assume that the average student participates for 1.5 years.[38]

Studies of similar programs have used less rigorous propensity score matching (PSM) methods and found much larger effects. Jill M. Constantine and colleagues found that Talent Search improves college enrollment by 6 to 18 percentage points (3 to 12 percentage points in two-year colleges and 3 to 7 percentage points in four-year colleges).[39] Likewise, Thurston Domina found that these types of college outreach programs improve college enrollment by about 6 percentage points (though they have essentially no impact on high-school educational performance).[40] Because of limitations in the methodology, I use the lower end of this range for the Talent Search impact estimates (ECR is equal to 0.0383).

Financial Aid Programs. Tuition is the heavily subsidized price of college paid by students. The cost of these subsidies (in public institutions) and grants to students are essentially the face value of the subsidy or grant. Some grants and scholarships have "merit" requirements based on courses and grades. The situation is more complicated with loans. Susan Dynarski estimates that the government subsidy for Stafford loans, in which all interest is paid by the government while the student is in school and interest rates are subsidized after students leave college, "is about a third of its face value."[41] This figure, however, is apparently based on what students with high credit ratings would obtain and probably overstates the credit situation of the average student. I estimate that the more typical subsidy is probably closer to 57 percent of face value.[42] I therefore assume that the cost to the federal government for a $1,000 loan is $600. This highlights how the cost of a $1 loan is less than the cost of a $1 grant.

With several colleagues, I carried out the Wisconsin Scholars Longitudinal Study (WSLS), which randomly assigned first-time-in-college, low-income students up to $3,500 for each of their 10 semesters in four-year colleges.[43] We pointed out that, because of federal rules, aid officers are required to reduce certain forms of aid, especially loans, when students receive grants and scholarships. For this reason, to calculate the cost of the WSLS, I added the net change in grant aid and subtracted the subsidy portion of the reduced loans.[44] On the basis of some new results from this study, with data covering the first three years, the cumulative average cost per treatment student is $1,785 per year. This is to our knowledge the only randomized trial of a need-based aid program.

The grants had small positive effects on GPA and credits, but no sustained impact on persistence.[45] One reason is that much of the aid was supplanted; as noted above, federal rules required aid officers to reduce other forms of aid, and students chose to reduce their loans as a result of the new grant. Some of the analyses suggest that students who *received* the largest increases in their total aid saw positive effects on persistence to the second year of college, but other parts of the analysis suggest that the aid effects fade out in the third and fourth years. We therefore used a minimum of zero and a maximum of a 2 percentage point increase in persistence.[46] Combining this with the costs translates to an ECR of 0.0070.[47]

MDRC's Opening Doors. Some financial aid programs are bundled with other student services. MDRC's Opening Doors project included an experiment that combined advising, counseling, and performance-based financial aid. On the basis of data from two community colleges, Lashawn Richburg-Hayes and colleagues reported that average total scholarship payment per student over two semesters was $1,246.[48] Based on the number of counselors employed and the national average salaries of these workers, I estimate the costs of the counselors to be $340 per student, so the total average cohort cost is $1,246 plus $340, which equals $1,586 (per year for two years).

MDRC's Opening Doors also included an experiment that combined services with performance-based aid. MDRC has released a series of reports suggesting that performance-based financial aid increases credit accumulation and enrollment in classes between the first and second semesters.[49] More recently, they summarize new findings that the program increased persistence from roughly 31.0 percent to 37.5 percent over four semesters, for an effect of 6.5 percentage points. This suggests that the adjusted ECR is 0.0171.

Canada STAR. While I generally focus on US-based results, I make one exception with the Canada STAR study. This is the only randomized trial of a performance-based aid program that occurred at a university, although another is ongoing. Like MDRC's Opening Doors, the STAR study featured both financial aid and student services. In addition to the control group, there were multiple treatments: (1) services only, such as facilitated study groups; (2) scholarship money only; and (3) a combination of services and scholarship money. The costs for these options are reported as $302, $366, and $739 per student, respectively.[50]

Joshua Angrist and colleagues reported a point estimate for the effect of the funding-only treatment on first-to-second-year persistence of 3 percentage points.[51] This figure was not statistically significant, but a much larger impact (more than 6 percentage points) was significant for males. This is important partly because the program ended after the first year, so any effect on second-year enrollment would have been based on residual benefits from the first year rather than the expectation of continued funding. This implies a 3 percentage-point impact of aid only and an adjusted ECR of 0.0200. The ECR for the combined financial aid and service is roughly half that size (0.0099) because the services almost doubled the costs and because the impact size remained roughly the same.

Other Studies of Financial Aid. I reviewed a long list of studies and consulted the literature review by David Deming and Susan Dynarski regarding the impacts from a large number of quasi-experimental studies.[52] Researchers commonly report aid effects as increased rates of attendance per $1,000 in aid. These calculations typically refer only to a single year of aid from a given program—however, they omit costs from subsequent years if students remain in college and continue meeting the program requirements. For this reason, as well as because of the cohort basis of our approach, the ECRs cannot be compared with the usual impact per $1,000 of aid. There is much less evidence on the impact of loans, though the two quasi-experimental studies I know of both find positive impacts.[53] The adjusted ECRs are 0.0064 for loans and 0.0063 for grants, nearly identical to the estimate for the WSLS.[54]

Student Services. Other categories that can help increase the number of college graduates include student counseling, student health services, and improved instruction, especially for students who are already far behind when they enter college.

Student Counseling. As part of the MDRC Opening Doors initiative, low-income students who were just starting college and who had histories of academic difficulties were provided additional counseling and given a small stipend of $300 per semester when they used those services in two Ohio community colleges. The average stipend was $210. Counselors had a much smaller than usual caseload (119 versus 1,000 in the control group) because of the expectation that they would be spending more time with each student. Students were also given a designated contact in the financial aid office. Researchers found that students did use counseling and financial aid services at greater rates than control group students (who also had access to standard campus services). On the basis of the number of counselors involved and the Bureau of Labor Statistics data on average counselor salaries, I estimate counselor costs of $340 per year per student. After adding counselor time to the student stipends, I find that the unadjusted cohort cost is $54,898.

MDRC studied the Opening Doors initiative with a randomized trial. Impacts were statistically significant during the one year the services were provided, though most of the initial effects diminished over time. The treatment increased persistence by 7 percentage points in the first semester by the end of the first year, after which point the program ended. Follow-up analysis suggests that the post-program impact was cut in half (to 3.7 percentage points) the first full semester after the program stopped and declined further thereafter. It is unclear what would have happened had the program continued. The impacts might have diminished even if the program had continued. More plausible is that the total impact of the program might be reflected in the impact estimated at the time the program ended, increasing the graduation rate by 3.7 percentage points. As an upper bound, consider that the impacts could have continued to accumulate if the program continued—that is, the program might have impacted the persistence rate, and the initial benefits might have been compounded. I take 3.7 percentage points as a middle-ground estimate of the impact on graduation. The adjusted ECR is 0.0281.

Miscellaneous Student Services. Douglas A. Webber and Ronald G. Ehrenberg pointed out that spending on non-instructional student services such as student organizations, intramurals, student health services (including psychological counseling), supplemental instruction (for example, tutoring), and admissions and registrar offices have grown more rapidly in recent years than instructional expenditures.[55] They used institution-level data from the Integrated Postsecondary Education Data System (IPEDS) to study the potential impacts of different categories of student services as well as other typical categories of college spending.[56] They found that spending on student services tends to increase student persistence, especially at colleges where students have low scores on college entrance exams and have lower family incomes. Instructional spending is also positively associated with graduation. Specifically, they found that a $500 per student increase in student services spending would increase the college graduation rate by 0.7 percentage points. This yields an adjusted ECR of 0.0034.

The adjusted ECR for the Opening Doors program (0.0281) is six times larger than that suggested by Webber and Ehrenberg (0.0034). What explains this divergence? Although the general spending on student services that Webber and Ehrenberg study reflects somewhat different types of services than in the MDRC experiment, and notwithstanding Webber and Ehrenberg's careful analysis, the large difference in ECRs may suggest that the regression-based estimates are biased downward. Also note that Webber and Ehrenberg focused on four-year students, whereas Opening Doors focused on two-year students.

InsideTrack. The company InsideTrack provides coaching services to nontraditional college students (average age of 31 years). According to Eric Bettinger and Rachel Baker, "The coaches call their students regularly and in some cases have access to course syllabi, transcripts, and additional information on students' performance and participation in specific courses. InsideTrack uses this additional information in a set of predictive algorithms that assess each student's status for the purpose of reaching out to them on the right issues at the right times."[57] The company charges a fee of $1,000 per year per student. Because the service is provided by a for-profit company, this price is likely to be a reasonable estimate of costs, though it is unclear whether colleges themselves incur other costs. I use the reported price.

The InsideTrack coaching program has been studied with a large multisite, randomized trial and is one of the most convincing studies available. Bettinger and Baker reported effects on both persistence and graduation.[58] Even though the services are only provided for one year, effects on university graduation were 4 percentage points. This yields an ECR of 0.0400.

> Spending on student services tends to increase student persistence, especially at colleges where students have low scores on college entrance exams and have lower family incomes.

Remediation. So far, I have considered programs that attempt to influence students indirectly—by changing the general faculty resources available (student-faculty ratios and adjuncts), providing various forms of services (for example, counseling and mentoring), and providing financial aid. But this means I have ignored what is arguably the core activity of colleges: instruction. Although few if any studies link instructional practices to persistence and graduation, researchers have paid considerable attention to remediation in recent years.

One growing concern is that students who enter college are not adequately prepared for college-level work. Although this situation is partly seen as a flaw of high-school preparation, many colleges try to address the issue through remediation programs. Placement in remediation is often based on standardized test scores. Texas spends $172 million per year on remediation programs that educated 162,597 (mostly four-year) students in 2006.[59] This translates to $1,057 per student, or $105,700 per cohort. Isaac McFarlin and Francisco Martorell found that remediation in Texas had no influence on student outcomes.[60]

Some researchers have expressed concern, however, that the quality of the typical remediation program is relatively low and that more extensive, high-quality programs would have a positive impact. Alicia C. Dowd and Laura M. Ventimiglia estimate the costs of a high-quality remediation program, Pathways, which includes a combination of math and language arts.[61] They estimate total costs of

TABLE 1
COST-EFFECTIVENESS OF HIGHER EDUCATION PROGRAMS

Program	Adjusted Cohort Cost (Real $)	Estimated Effect on Graduation	Effectiveness-Cost Ratio (ECR)
College Access (disadv)			
Talent Search	58,800	2.25	0.0383
Upward Bound	1,015,500	1.50	0.0015
Financial Aid			
Grants	355,000	2.25	0.0063
WSLS-min	633,675	0.00	0.0000
WSLS-max	284,710	2.00	0.0070
Loans	233,700	1.50	0.0064
Merit Aid (GA/AR)	410,000	3.00	0.0073
Merit Aid (Canada STAR)	150,060	3.00	0.0200
Financial Aid with Services			
Canada STAR	302,990	3.00	0.0099
Opening Doors (2y; disadv)	304,512	5.20	0.0171
Instruction			
Stud/Fac Ratio (4y)	133,500	1.11	0.0083
Stud/Fac Ratio (2y)	20,281	0.03	0.0015
Full-Time Faculty (4y)	843,542	4.60	0.0055
Full-Time Faculty (2y)	551,422	10.00	0.0181
Remediation (Bett./Long) (disadv)	170,000	10.00	0.0588
Student Services			
Student Services (Webber/Ehr)	205,000	0.70	0.0034
Student Counseling (2y; disadv)	105,404	2.96	0.0281
Inside Track (4y)	100,000	4.00	0.0400

Source: Author's Calculations.
Notes: Adjusted costs are the annual costs reported in the text multiplied by the average years of participation in the program. The effects on graduation sometimes reflect effects reported in studies where the researchers studied graduation, and in other cases, they reflect an effect on college entry or persistence that is adjusted so that it reveals the expected effect on graduation. "GA/AR" refers to the Georgia and Arkansas residential scholarship.

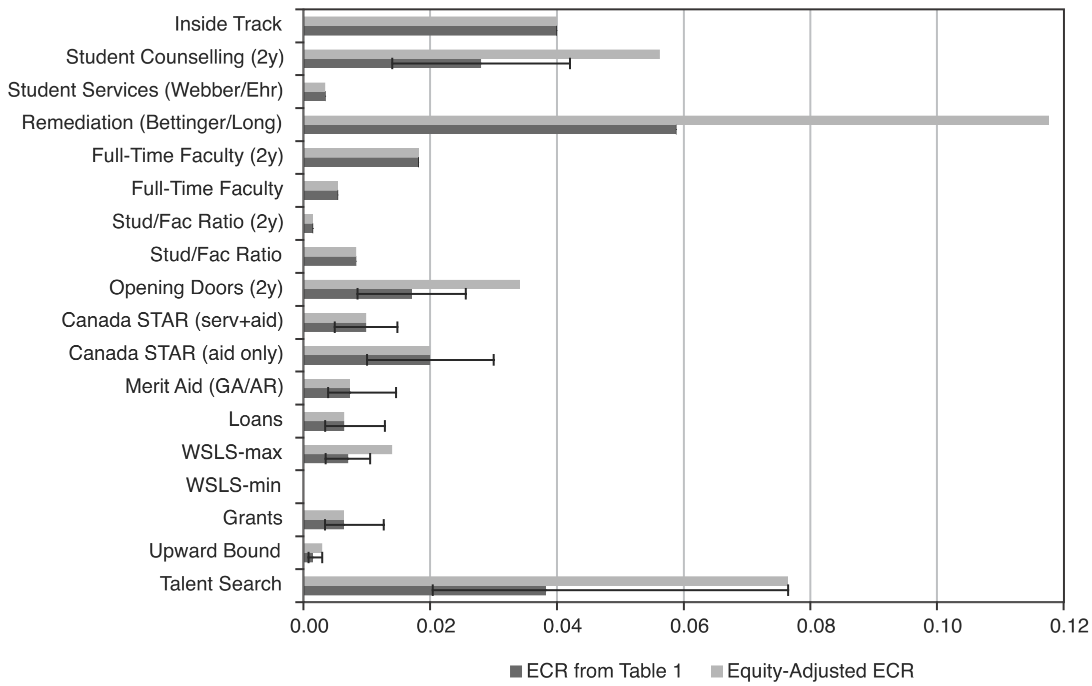
$1,700 per student session. This yields an unadjusted cohort cost of $170,000 per year, which, as expected, is somewhat higher than the cost of standard remediation that I reported earlier.

Although some studies have identified positive short-term impacts of remediation on early persistence, two rigorous studies find no impact on degree completion.[62] Still, a quasi-experiment by Bettinger and Bridget Terry Long found that remediation increases the probability of receiving a degree by 10 percentage points.[63] This leads to a bit of a conundrum. If we accept the results of McFarlin and Martorell, then the ECR is zero, but if we accept the results of Bettinger and Long, the ECR is 0.0588.[64] This case, along with the Upward Bound program case, are among the few instances where there are multiple rigorous studies, which allows such conflicts to emerge.

Interpreting the Results

The results of the cost calculations are summarized in the left-hand column of table 1. Costs for a cohort of 100 students clearly vary widely, from as low as $20,281 for reducing the student-faculty ratio slightly in two-year colleges to more than $1 million—50 times as much—for Upward Bound. From a productivity standpoint, this means reduced faculty-student ratios could produce tiny

FIGURE 2
EQUITY-ADJUSTED AND BOUNDED COST-EFFECTIVENESS RATIOS



Source: Author's Calculations.
Notes: The darker bar for each program indicates the ECR from the text. The black bands within some of those lower bars indicate bounds for estimates where program evidence is only available for college entry or persistence and therefore where a range of impact multipliers are used. The equity-adjusted ECRs are based on the assumption that the outcomes of disadvantaged groups count twice as much as the average. The bands also apply to the equity-adjusted ECRs, but are omitted so that the x-axis spans a narrower range, allowing for greater clarity of the small ECR levels. "GA/AR" refers to the Georgia and Arkansas residential scholarship.

impacts and still be worthwhile. Likewise, expensive programs may be cost-effective, but only if they generate very large impacts on student outcomes.

The second column of table 1 reports the estimated effect on graduation, and the last column divides the effects by the costs—the ECRs discussed throughout this section. The results vary widely, from an ECR of 0.0015 for Upward Bound and two-year faculty-student ratios to 0.0588 for remediation. No single strategy stands out as particularly cost-effective. The results vary most within the instructional category, and financial aid seems to generate more consistent but low cost-effectiveness ratios. Although the purpose here is not to draw conclusions about specific policies, these observations highlight the potential value of this approach.

Most of the ECRs are related to four-year degrees, but the distinction between those and two-year degrees should not be forgotten. We also see evidence that programs such as student services, which appear to be effective in one sector (such as MDRC's Opening Doors study of two-year colleges) seem ineffective in another sector (the Canada STAR study of a four-year college).

Of course, all of this analysis assumes that we take the ratios at face value—that is, if we can ignore the questions posed at the beginning of this chapter. I report the same point estimates from table 1 in figure 2 (the darker bars), but add bands to reflect the reasonable ranges. Some of the point estimates have no ranges because the estimates were based on actual graduation rather than assumptions about the multipliers to convert the estimates on entry and persistence. Of course, all the estimates contain unknown degrees of sampling error that are not reflected here.

The lighter bars for each program in figure 2 reflect equity-adjusted ECRs under the assumption that the outcomes of economically disadvantaged groups are twice as important as those for the average student. If you agree with the equity adjustment, then you can focus only on the top bars. With this approach, targeted student counseling, Opening Doors, and WSLS (maximum estimate) all see their ECRs leapfrog at least one program not targeted to disadvantaged students. Remediation could be added to the list because although family income is not an explicit consideration in assignment to remediation, disadvantaged students are more likely to have the lower level of academic skills and test scores that trigger remediation participation. In this respect, a well-executed remediation may be the most cost-effective option for this group.

The absence of the type of information that would be needed to improve productivity is perhaps the strongest evidence that we are falling short of our productivity potential.

Recall that economists also sometimes carry out cost-benefit analyses that focus on the increased earnings of college graduates. Benefit-cost ratios for most of the programs are available on request, but note that 72 percent of the programs discussed in table 1 pass a cost-benefit test. Among those that barely pass the cost-benefit test are grants, loans, and merit aid, though each of these also has many more cost-effective programs ranked above them. This highlights the fact that programs can look good when we examine them individually and consider only whether they pass a cost-benefit test, but the same programs look worse when we compare them to the alternatives.

I recognize that some researchers might have alternative definitions of "disadvantaged" and that some might value the outcomes of these groups in different ways. Also, precise impact estimates of the proportion of students deserving any disadvantaged designation are not available. Again, the advantage of including these equity-adjusted results is that they reduce the likelihood that the importance of equity will be lost in policy deliberations.

Conclusion

The combination of growing demand for college credentials and declining degree productivity is a serious problem. It will be very difficult to reach the lofty education goals that US policymakers are setting—or even avoid continued decline in tight fiscal times—without improving productivity. I argue, in contrast to the "cost disease" and the larger debate on higher education, that some productivity improvements are possible. Some programs are extremely expensive, with little evidence to justify those high costs. Moreover, the differences in measured cost-effectiveness are so large that it is hard to ignore them. Among those programs with positive effects, the largest ECR is 39 times larger than the smallest ECR.

While the number and nature of the assumptions in the analysis should clearly give some pause when individuals use this research to inform policy, their main function is to prompt policymakers, researchers, and analysts alike to pose the questions necessary for reasonable interpretations of the evidence. My goal with this analysis is to add some useful structure to those decisions, not to encourage decisions based on mindless and mechanistic applications of ECR rankings. There is a risk that the assumptions and caveats I have laid out here might be ignored in the decision-making process, which would partly undermine the objective, though that might be at least as likely if, as in most studies, these assumptions are never outlined. Of particular concern is that we have almost no evidence of the impacts of programs on degree *quality*. As with most tools, I think this one can be helpful if used well and can be possibly damaging if not used as intended. Given the significance of the cost and productivity problem, and the apparently vast differences in cost-effectiveness observed here, I believe this approach is worth considering.

I do not claim that colleges could get back to productivity rates from decades past. The cost disease and other pressures driving costs up and degrees down are real, powerful, and to a certain extent unavoidable. But that should not excuse the dearth of rigorous evidence and the failure to integrate costs and effectiveness in policy decision making. The absence of the type of information that would be needed to improve productivity—a hole that I hope this study begins to fill—is perhaps the strongest evidence that we are falling short of our productivity potential.

Going forward, new research will no doubt aid in filling some of the empirical gaps that hamper our analysis. Data for studying higher education are increasingly available for research purposes through, for example, the National Student Clearinghouse and developing state administrative data systems. Moreover, adding analysis of costs has long been possible but rarely carried out. I have provided a framework on which future cost-effectiveness research can be based, but this should not be left to just the occasional review article. Every study of impacts should at least briefly discuss program costs, or else these studies will tell only half the story. College leaders should consider filling these research holes on their own because cost-effectiveness often varies depending on the campus context.

The larger point is that colleges are not completely helpless in addressing productivity, as some appear to assume. These results suggest a need to break out of this mindset, to search actively for new and better ways to help students, and to study program costs and effects more carefully so that policymakers and college leaders can make more informed decisions about how to allocate scarce resources.

Notes

I gratefully acknowledge the financial support of the Lumina Foundation. For their useful advice, I wish to thank Charles Clotfelter, Colin Chellman, Matthew Chingos, Kristin Conklin, Sara Goldrick-Rab, Andrew Kelly, Michael McPherson, Susanna Loeb, David Mundel, Michael Olneck, Noel Radomski, David Weimer, John Wiley, and participants in symposia organized by the City University of New York, the Lumina Foundation's Making Opportunity Affordable initiative, the Wisconsin Center for the Advancement of Postsecondary Education, and the Association for Education Finance and Policy. For research assistance, I thank Gregory Kienzl, Regina Brown, Alan Nathan, Byoung-Ik Jeoung, and So Jung Park. All errors are our own.

1. Note that here and elsewhere in the paper, I use "productivity" and "efficiency" somewhat interchangeably, though, strictly speaking, the former refers to output per unit of input (for example, labor hours), whereas "efficiency" has a broader meaning. I adopt "productivity" here to align the discussion with how policymakers more typically use the terms in this context.

2. Charles T. Clotfelter, *Buying the Best: Cost Escalation in Elite Higher Education* (Princeton, NJ: Princeton University Press, 1996); and Arthur Hauptman and Young Kim, *Cost, Commitment, and Attainment in Higher Education: An International Comparison* (Boston: Lumina Foundation and Jobs for the Future, 2009).

3. Martha J. Bailey and Susan M. Dynarski, "Inequality in Postsecondary Education," in *Wither Opportunity: Rising Inequality, Schools, and Children's Life Chances*, ed. Greg Duncan and Richard Murnane (New York: Russell Sage Foundation, 2011); and John Bound, Michael Lovenheim, and Sarah Turner, *Why Have College Completion Rates Declined?* (working paper 15566, National Bureau of Economic Research, Cambridge, MA, 2009).

4. This measure of productivity is imperfect because, for example, the resources included in the four-year (two-year) sector expenditures are not all supposed to go toward Bachelor of Arts (Associate of Arts) production, but the nondegree roles of colleges have not changed significantly over this time period, so this probably influences the productivity level but not the trend.

5. Productivity in 2006 was 81 percent of 1970 levels. Current expenditures in 2007 on four-year colleges were $196 billion. See US Department of Education, National Center for Education Statistics, 2003–04 through 2006–07 Integrated Postsecondary Education Data System, "Table 362: Expenditures of Public Degree-Granting Institutions, by Purpose of Expenditure and Type of Institution: 2003–04 through 2006–07," 2010, http://nces.ed.gov/programs/digest/d09/tables/dt09_362.asp. Assuming the trend continues, productivity in 2050 will be 81 percent of 2010 levels, and this will require an additional $42 billion to generate the same degrees. This slightly understates the additional resources because the figure represents only 36 years rather than 40, so the extrapolated productivity would actually be slightly larger. These calculations exclude two-year colleges because productivity is largely unchanged in that sector. The calculations also exclude private colleges, for which less data are available.

6. There were 6.1 million FTE undergraduates in public four-year colleges in 2008. See US Department of Education, National Center for Education Statistics, Higher Education General Information Survey, "Fall Enrollment in Colleges and Universities" (1969–1985); and 1986 through 2008 Integrated Postsecondary Education Data System, "Fall Enrollment Survey," 2010. Dividing the $42 billion by this number yields $6,885. By comparison, according to the Delta Cost Project, tuition at public research universities was $6,741 ($5,004) in public research (public master's) institutions in 2006. See Delta Cost Project, *Trends in College Spending* (Washington, DC: Delta Cost Project, 2009).

7. William J. Baumol and William G. Bowen, *Performing Arts: The Economic Dilemma* (New York: Twentieth Century Fund, 1966); G. C. Winston, "Subsidies, Hierarchy and Peers: The Awkward Economics of Higher Education," *Journal of Economic Perspectives* 13 (Winter 2009): 13–36; Dan Black and Jeffrey Smith, "Evaluating the Returns to College Quality with Multiple Proxies for Quality," *Journal of Labor Economics* 24, no. 3 (2006): 701–28; Liang Zhang, "Do Measures of College Quality Matter? The Effect of College Quality on Graduates' Earnings," *Review of Higher Education* 28, no. 4 (2005): 571–96; Robert B. Archibald and David H. Feldman, "Explaining Increases in Higher Education Costs," *Journal of Higher Education* 79, no. 3 (2008): 268–95; Robert B. Archibald and David H. Feldman, "Why Do Higher Education Costs Rise More Rapidly Than Prices in General? *Change* (May/June 2008): 25–31; and Douglas N. Harris and Sara Goldrick-Rab, "The (Un)Productivity of American Higher Education: From 'Cost-Disease' to Cost-Effectiveness" (working paper, Wisconsin Center for the Advancement of Postsecondary Education, Madison, December 2010).

8. With regard to the role of rising costs, see William J. Baumol and Sue Anne Blackman, "How to Think about Rising College Costs," *Planning for Higher Education* 23 (Summer 1995): 1–7; Howard R. Bowen, *The Costs of Higher Education: How Much Do Colleges and Universities Spend Per Student and How Much Should They Spend?* (San Francisco: Jossey-Bass, 1980); David W. Breneman, "An Essay on College Cost," in *Study of College Costs and Prices, 1988–89 to 1997–98, Volume 2* (Washington, DC: National Center for Education Statistics, 2001), 13–20; Ronald G. Ehrenberg, *Tuition Rising: Why College Costs So Much* (Cambridge, MA: Harvard University Press, 2000); Malcom Getz and John J. Siegfried,

"Cost and Productivity in American Colleges and Universities," in *Economic Challenges in Higher Education*, ed. Charles Clotfelter et al. (Chicago: University of Chicago Press, 1991), 261–392; Dennis Jones and Jane Wellman, "Bucking Conventional Wisdom on College Costs," *Inside Higher Ed*, July 20, 2009, www.insidehighered.com/views/2009/07/20/wellmanjones; Richard Vedder, *Going Broke by Degree: Why College Costs Too Much* (Washington, DC: AEI Press, 2004); and Burton A. Weisbrod, Jeffrey P. Ballou, and Evelyn D. Asch, *Mission and Money: Understanding the University* (New York: Cambridge University Press, 2008). With regard to declining degree attainment, see William G. Bowen, Matthew M. Chingos, and Michael McPherson, *Crossing the Finish Line: Completing College at America's Public Universities* (Princeton, NJ: Princeton University Press, 2009).

9. Archibald and Feldman, "Explaining Increases in Higher Education Costs," 270.

10. John Immerwahr, Jean Johnson, and Paul Gasbarra, *The Iron Triangle: College Presidents Talk about Costs, Access, and Quality* (San Jose, CA: National Center for Public Policy and Higher Education and the Public Agenda, 2008). Direct quotations are not included in the cited paper but were collected as part of the study and provided by the cited authors.

11. Exceptions include William F. Massy, "Productivity Issues in Higher Education," in *Resource Issues in Higher Education*, ed. William F. Massy (Ann Arbor: University of Michigan Press, 1996); and Michael McPherson, Morton Owen Schapiro, and Gordon C. Winston, *Paying the Piper: Productivity, Incentives, and Financing in U.S. Higher Education* (Ann Arbor: University of Michigan Press, 1993).

12. Sara Goldrick-Rab and Josipa Roksa, *A Federal Education Agenda for Promoting Student Success and Degree Completion* (Washington, DC: Center for American Progress, 2008).

13. David H. Monk and Jennifer A. King, "Cost Analysis as a Tool for Educational Reform," in *Reforming Education: The Emerging Systemic Approach* (1994 Yearbook of the American Education Finance Association), ed. Stephen L. Jacobson and Robert Berne (Thousand Oaks, CA: Corwin, 1993); Jennifer King Rice, "Cost Analysis in Education Policy Research: A Comparative Analysis across Fields of Public Policy," in *Cost-Effectiveness Analysis in Education: Progress and Prospects* (2002 Yearbook of the American Education Finance Association), ed. Henry M. Levin and Patrick McEwan (Larchmont, NY: Eye on Education, 2002).

14. Exceptions include Massy, "Productivity Issues . . . "; and McPherson, Schapiro, and Winston, *Paying the Piper . . .*

15. This is not the only way to think about costs. The discussion of costs here ignores the distinction between opportunity costs and budgetary costs that economists typically make. Opportunity cost refers to the value of a resource in its next best use. When markets are competitive, the market price accurately reflects opportunity cost. In some cases the two notions of costs do not line up. Of particular relevance here is that financial aid programs are considered transfer payments and are costly in a budgetary sense, but not as opportunity costs.

16. This is not always the case. If the ratio is negative because a positive impact is generated with reduced (negative) costs, then this is an exception to the rule, and the negative ECR is a positive indication of the social value of the program. But if the ratio is negative because the impact is negative and the costs are positive, this obviously reflects poorly on the program. Positive ECRs can also be generated with a combination of negative costs and negative effects. Such a program might be worthwhile if the sacrifice of lower outcomes is worth the lower costs so that the resources could be redeployed to more cost-effective options.

17. Some programs or policies engage students before college entry, and others affect them after entry. The timing of the entering cohort aligns with the timing of the program—if the program begins in high school, then I consider a cohort of 100 high-school freshmen; if it begins in college, then I consider a cohort of 100 college freshmen. This distinction is intended to make the ECRs as comparable as possible across programs.

18. Both figures account for a fringe benefit rate of 25 percent. See *Public Education Finances* (Washington, DC: Census Bureau, 2005). The four-year figure is somewhat higher than the $354,000 reported by Barrow and Rouse, partly because they chose a higher discount rate. See Lisa Barrow and Cecilia E. Rouse, "The Economic Value of Education by Race and Ethnicity," *Economic Perspectives* 30, no. 2 (2006).

19. Harris and Goldrick-Rab, "(Un)Productivity of American Higher Education . . . "

20. First, I consider evidence from the small number of studies that report program impacts on multiple outcomes; for example, reports that the point estimates for financial aid impacts are about 25 percent smaller when the outcome is obtaining at least one year of college compared with when the outcome is entering college. This implies an entry-to-persistence multiplier of about 0.75. See Susan Dynarski, "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion," *American Economic Review* (2003): 279–88; and Eric Bettinger and Rachel Baker, "The Effects of Student Coaching: An Evaluation of a Randomized Experiment in Student Mentoring" (working paper 16881, National Bureau of Economic Research, Cambridge, MA, 2011). Bettinger and Baker report effects of college coaching on retention 12 months from initial entry as well as graduation. Their graduation effects are roughly 30 percent larger than the effects on persistence, suggesting multipliers above 1.0 are realistic. I discuss these studies and the programs involved in greater detail. The goal here is only to show how I am using the studies to identify plausible ways of translating effects on entry and persistence into effects on graduation. As a second approach, I combined a simple compounding model of persistence with evidence on typical persistence and graduation rates from the *Beginning Postsecondary Study.* See *Beginning Postsecondary Study* (National Center for Education Statistics, 2004–09). These two approaches yield a range of possible values that I use as lower and upper bounds, as well as our baseline values that are the basis for our main results.

21. The "faculty resources" component represents 20 percent of the total rating. Sixty-five percent of this portion is composed of "percent faculty that is full time" (5 percent), "percent faculty with terminal degree in field" (15 percent), "student/faculty ratio" (5 percent), "class size 1–19 students" (30 percent), and "class size 50+ students" (10 percent). See *U.S. News and World Report*, "Methodology: Undergraduate Ranking Criteria and Weights," www.usnews.com/articles/education/best-colleges/2009/08/19/methodology-undergraduate-ranking-criteria-and-weights.html.

22. Daniel Jacoby, "The Effects of Part-Time Faculty Employment on Community College Graduation Rates," *Journal of Higher Education* 77, no. 6 (2006): 1081–1103. For brevity throughout this paper, when reporting data simultaneously for four- and two-year colleges, I report the two-year figure in parentheses immediately after the four-year figure.

23. *Digest of Education Statistics, 2007* (Washington, DC: National Center for Education Statistics, 2007), table 237.

24. *National Study of Postsecondary Faculty, 2004* (Washington, DC: National Center for Education Statistics, 2004).

25. I could not find a nationally representative fringe rate and instead used a rate of 25 percent, using data for public-school teachers. See US Census Bureau, *Public Education Finances*.

26. One study found that larger classes lead to lower GPAs in one US public university. See Edward C. Kokkelenberg, Michael Dillon, and Sean M.Christy, "The Effects of Class Size on Student Grades at a Public University," *Economics of Education Review* 27, no. 2 (2008): 221–33. Another study examined class size using data from Italy. See Maria De Paola and Vincenzo Scoppa, "Effects of Class Size on Achievement of College Students" (working paper 16945, Munich Personal RePEc Archive), http://mpra.ub.uni-muenchen.de/16945/.

27. Bound, Lovenheim, and Turner, *Why Have College Completion Rates Declined?*

28. *National Study of Postsecondary Faculty, 2004*.

29. Ronald G. Ehrenberg and Liang Zhang, "Do Tenured and Tenure-Track Faculty Matter?" (working paper 10695, National Bureau of Economic Research, Cambridge, MA, 2004). The study does not use college-fixed effects, as would be necessary to characterize this as an interrupted times series or quasi-experiment. The authors indicate that there was insufficient variation to use such an approach with their data. Instead, they simply aggregate data across years.

30. Jacoby, "Effects of Part-Time Faculty Employment . . . "

31. Not all the evidence on part-time faculty is so negative; in a forthcoming study, Eric Bettinger and Bridget Terry Long, using a quasi-experimental technique, find that adjuncts increase interest in subsequent course enrollment, relative to full-time faculty.

32. David Myers et al., *The Impacts of Regular Upward Bound: Results from the Third Follow-Up Data Collection* (Washington, DC: Mathematica Policy Research, 2004); and Amy Albee, "A Cost Analysis of Upward Bound and GEAR UP" (unpublished manuscript, Florida State University, 2005).

33. Neil S. Seftor, Arif Mamun, and Allen Schirm, *The Impacts of Regular Upward Bound on Postsecondary Outcomes 7–9 Years after Scheduled High School Graduation* (Washington, DC: Mathematica Policy Research, November 2008).

34. Alan Nathan and Douglas N. Harris, "Does Upward Bound Have an Effect on Student Educational Outcomes? A Reanalysis of the Horizons Randomized Controlled Trial," (annual meeting of the Society for Research on Educational Effectiveness, Washington, DC, 2013).

35. Upward Bound increased postsecondary enrollment or completion rates for the 20 percent of eligible students who had lower educational expectations (no expectation of earning a bachelor's degree) at baseline. Nevertheless, because being eligible for Upward Bound requires a considerable degree of disadvantage to begin with, those students who also have low educational expectations are extremely disadvantaged. Therefore, for comparability with other program ECRs in this study, I use the 2-percentage-point impact as the baseline. The focus on overall impacts is also preferable because Upward Bound does not limit access on the basis of college expectations, nor is it likely to do so in the future.

36. Council for Opportunity in Education, *Request for Correction for the Report: The Impacts of Regular Upward Bound on Postsecondary Outcomes 7–9 Years after Scheduled High School Graduation (Mathematica Fifth Follow Up Report*) (Washington, DC: Mathematica Policy Research, 2012). A reanalysis of the original Upward Bound experiment is being carried out by Alan Nathan, a doctoral student at the University of Wisconsin at Madison. I am his adviser on the analysis.

37. Jill M. Constantine et al., *A Study on the Effect of the Talent Search Program on Secondary and Postsecondary Outcomes in Florida, Indiana, and Texas* (Washington, DC: US Department of Education, Office of Planning, Evaluation, and Policy Development, 2006).

38. With college access programs, the cost multipliers in table 1 are no longer relevant because program participation is usually short-lived.

39. Constantine et al., *A Study on the Effect of the Talent Search Program* . . .

40. Thurston Domina, "What Works in College Outreach: Assessing Targeted and Schoolwide: Interventions for Disadvantaged Students," *Educational Evaluation and Policy Analysis* 31, no. 2 (2009): 127–52.

41. Susan Dynarski, "Loans, Liquidity, and Schooling Decisions" (unpublished working paper, University of Michigan, Ann Arbor, 2003), 21, www.nber.org/dynarski/Dynarski_loans.pdf.

42. I am not aware of any direct evidence on the credit histories of students or their parents (who usually cosign on the loans). Dynarski's one-third subsidy figure assumes that the market interest rate is 7 percent, which she describes as the rate for borrowers with excellent credit histories. She writes that the rate for borrowers with poor credit histories was 9 percent. For market rates of 7, 8, and 9 percent, and a (subsidized) Stafford loan interest rate of 6 percent, the present discounted value to students of the reduced interest charges is 37 percent, 57 percent, and 77 percent (respectively). The first figure most closely matches Dynarski's assumptions. The estimates incorporate both the lower interest rate and the fact that the government pays all interest while students are in school. I assumed a 10-year repayment schedule and two years of time in college with complete government subsidy. Although interest rates have been lower recently, this is unlikely to continue, and I view the chosen market rates as more realistic. I therefore use the middle figure as our cost estimate, which I believe best represents the average student; however, the correct rate certainly varies across individuals.

43. Sara Goldrick-Rab et al., *Need-Based Financial Aid and College Persistence: Experimental Evidence from Wisconsin* (Madison, WI: Institute for Research on Poverty, 2012).

44. This calculation ignores nonsubsidized loans because these costs are borne entirely by students. It also ignores changes in work study because (1) the budgetary implications are ambiguous and (2) the change in work study was very small.

45. Goldrick-Rab et al., *Need-Based Financial Aid and College Persistence . . .*

46. I arrived at this as follows: the largest persistence effect reported anywhere in the paper is positive 4.1 for persistence to the second year in a particular subset of colleges (on the basis of instrumental variables estimation). The most optimistic estimate of the fade out comes from the second cohort, where the persistence effect drops by half from the second to the third year. (In the first cohort, the effect reverses sign; that is, the persistence effect is negative.) Therefore, if we assume the persistence effect of aid received also drops by half, then the persistence effect goes from positive 4.10 to positive 2.05. This is the effect reported in the text and in figure 2. This also assumes that the instrumental variables estimate (that is, the "local average treatment effect") applies to all the aid changes, which is probably not the case.

47. The cost calculation is complicated by the estimation method of the maximum effect, which is why the costs reported in the second column of table 1are so different for the WSLS minimum effect. The estimation method yields an estimate of the effect per $1,000 of additional total aid, which combines loans and grants. I therefore adjusted the total aid cost downward because, as noted in the text, loans are less expensive than grants to the government and colleges that provide them. If all aid were grants, then this would be reported as $100,000 ($1,000 per student), but the adjustment reduces this by the share of aid that is in the form of grants (0.67) multiplied by the reduced cost of each dollar of loans (0.60). This yields 1.00 minus (0.033 times 0.6) times $100,000, which equals $80,200. This figure was then multiplied by 3.55, the estimated number of years these students would receive funding.

48. Lashawn Richburg-Hayes et al., *Rewarding Persistence: Effects of a Performance-Based Scholarship Program for Low-Income Parents* (New York: MDRC, 2009).

49. Ibid.

50. Joshua Angrist, Daniel Lang, and Philip Oreopoulos, "Incentives and Services for College Achievement: Evidence from a Randomized Trial," *American Economic Journal: Applied Economics* 1 (2009): 136–63.

51. Joshua Angrist, Daniel Lang, and Philip Oreopoulos, "Lead Them to Water and Pay Them to Drink: An Experiment with Services and Incentives for College Achievement" (working paper 12790, National Bureau of Economic Research, Cambridge, MA, 2006).

52. David Deming and Susan Dynarski, "Into College, Out of Poverty? Policies to Increase the Postsecondary Attainment of the Poor" (working paper 15387, National Bureau of Economic Research, Cambridge, MA, 2009).

53. Suzanne Louise Reyes, "Educational Opportunities and Outcomes: The Role of the Guaranteed Student Loan" (unpublished manuscript, Harvard University, Cambridge, MA, 1995); and Dynarski, "Loans, Liquidity, and Schooling Decisions."

54. The apparently larger ECR for loans could be the result of the estimates being biased (especially in the case of loans where there is much less evidence). Alternatively, students face minimum thresholds for funds to cover the most basic college costs (for example, tuition), and perhaps the loans, which are used only after grants and scholarship have been exhausted, are more typically bumping students over that threshold.

55. Douglas A. Webber and Ronald G. Ehrenberg, "Do Expenditures Other Than Instructional Expenditures Affect Graduation and Persistence Rates in American Higher Education?" *Economics of Education Review* 29, no. 6 (2010): 947–58.

56. Like the financial aid studies, the costs here are already expressed in dollar terms, so there was no need for additional analysis. The IPEDS categories are instructional, academic support (libraries, museums, academic computing), research, and student services.

57. Eric Bettinger and Rachel Baker, "The Effects of Student Coaching: An Evaluation of a Randomized Experiment in Student Advising" (unpublished manuscript, Stanford University School of Education, Stanford, CA, 2011), 9–10.

58. Ibid.

59. Paco Martorell and Isaac McFarlin, "Help or Hindrance? The Effects of College Remediation on Academic and Labor Market Outcomes" (unpublished manuscript, 2007); and Brooke D. Terry, *The Costs of Remedial Education* (Austin: Texas Public Policy Foundation, 2007).

60. Paco Martorell and Isaac Mcfarlin, "Help or Hindrance? The Effects of College Remediation on Academic and Labor Market Outcomes." *The Review of Economics and Statistics* 93, no. 2 (2011): 436–54. A similar study in Florida found the same results. See Juan Carlos Calcagno and Bridget Terry Long, "The Impact of Postsecondary Remediation Using a Regression Discontinuity Approach: Addressing Endogenous Sorting and Noncompliance" (working paper 14194, National Bureau of Education Research, July 2008).

61. Alicia C. Dowd and Laura M. Ventimiglia, "A Cost Estimate of Standards-Based Remediation in a Community College Developmental Education Program" (unpublished manuscript, University of Southern California, Los Angeles, CA, and North Shore Community College, Danvers, MA, 2008).

62. Paul Attewell et al., "New Evidence on College Remediation," *Journal of Higher Education* 77, no. 5 (September–October 2006): 886–924; Calcagno and Long, "The Impact of Postsecondary Remediation Using a Regression Discontinuity Approach . . . "; and Martorell and McFarlin, "Help or Hindrance . . . "

63. One study uses an instrumental variable (IV) that takes advantage of the fact that (1) different colleges in Ohio have different remediation policies, and (2) different students are located closer to, and are therefore more likely to attend, colleges with policies that affect whether they are placed in remediation. Eric P. Bettinger and Bridget Terry Long, "Addressing the Needs of Under-Prepared Students in Higher Education: Does College Remediation Work?" (working paper 11325, National Bureau of Economic Research, Cambridge, MA, 2005).

64. McFarlin and Martorell's point estimates are a fraction of the size of Bettinger and Long's estimates, so even if we ignored statistical significance, the ECR based on the McFarlin and Martorell estimates would be close to zero. I use the cost estimate from Dowd and Ventimiglia and the Bettinger and Long impact estimate. See Martorell and McFarlin, "Help or Hindrance . . . "; Bettinger and Long, "Addressing the Needs of Under-Prepared Students in Higher Education . . . "; and Dowd and Ventimiglia, "A Cost Estimate of Standards-Based Remediation . . . "