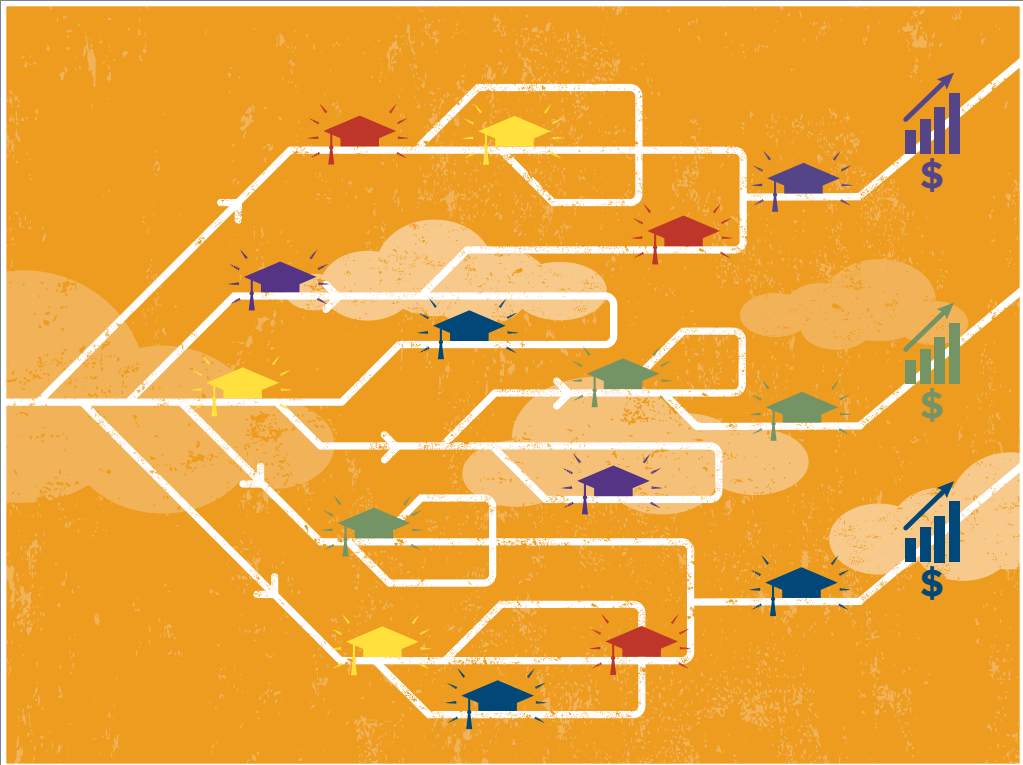# The Economic Impact of Increasing College Completion

Sophia Koropeckyj, Chris Lafakis,
and Adam Ozimek
Moody's Analytics

Foreword by Michael S. McPherson

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The descriptions, interpretations, and opinions contained in this publication are those held by the authors and do not necessarily represent the views of the Officers and Members of the American Academy of Arts & Sciences or the Commission on the Future of Undergraduate Education.

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Foreword

There is increasing evidence that smart investments in the education of college students from disadvantaged backgrounds can raise their college completion rates by meaningful amounts. The celebrated Accelerated Study in Associate Program (ASAP) at the City University of New York (CUNY) shows that a combination of more generous financial aid, free public transportation, and other steps that encourage students' rapid progress can raise completion rates by roughly 50 percent at a cost that is about 50 percent higher than the standard CUNY program for full-time students. As a result of improved graduation rates, ASAP has lower cost per *completed* degree than the regular program.

An increasing number of other community colleges and public universities report similar improvements in degree completion through introducing programs that emphasize structure and support for students. Such programs, often referred to as "guided pathways," track student progress very closely, in some cases relying on Big Data to help identify pathways that work well for students with particular characteristics, and also to help identify data that signal that a student is falling off the path to success. Advisors are trained to intervene rapidly to help a student get back on track and to ensure there is ongoing adequate financial support. These programs aren't free of cost but as with ASAP, they can often actually lower the cost per completed degree, which is after all the source of the main "payoff" to higher education. Of course, these efforts don't work for everybody and our knowledge of how to make them work in varied settings is still developing.[1]

These early successes have led the American Academy of Arts and Sciences' Commission on the Future of Undergraduate Education[2] to investigate the costs and benefits of a sustained investment program aimed at boosting program completion rates, especially for disadvantaged students. Some of the benefits of greater educational success for students are easier to quantify than others. More active and effective participation in community and civic life is an important benefit of a better educated population, but one that is hard to put a number on. There is evidence that greater educational success translates into better parenting, reduced likelihood of criminal activity, and so on—perhaps quantifiable in principle but not readily in practice.

1. For example, a recent economic analysis on effective strategies to increase college enrollment and completion rates finds that increasing institutional spending has a greater effect on enrollment and completion than cutting student tuition. See David J. Deming and Christopher R. Walters, *The Impact of Price Caps and Spending Cuts on U.S. Postsecondary Attainment*, August 2017; https://scholar.harvard.edu/files/ddeming/files/DW_Aug2017.pdf.

2. To learn more about the American Academy of Arts and Sciences' Commission on the Future of Undergraduate Education, a multi-year project generously funded by Carnegie Corporation of New York, please visit www.amacad.org/cfue.

Still, one of the best established and most easily quantified outcomes of college success is improved employment prospects and higher incomes. For example, typically people with only a high school degree are roughly twice as likely to be unemployed as are bachelor's degree holders of the same age. Substantial and persistent earnings benefits are likewise well-established. Moreover, these economic benefits extend not only to individuals but to the economy as a whole, as college-educated workers spend more time in the workforce and display higher productivity while working. We also know that the economic benefits of working in a better educated community "spill over" from the individual workers to the productivity of the entire community.

But while the benefits are real, raising the educational level of the workforce also entails significant cost. Programs to boost completion rates at individual institutions usually involve added expenses, as does investing in better college preparation in earlier education. While schools and colleges, even as they make these investments, may be able to save money in other ways, perhaps through technology or cutting back on lower priority programs, it would be wishful thinking to assume that we can substantially improve educational success for disadvantaged students without investing money in the effort. Besides the direct costs of investing in programs like ASAP or "guided pathways" models, there are also indirect costs of improving college completion. As dropout rates fall, students will stay in school and out of the labor force longer. Older adults will often leave or else cut back their hours on their current low-paying jobs as they invest in a better future. These are real costs to the economy in the near term.

A natural question to ask, therefore, is whether the economic benefits of investing in improving the educational level of the workforce exceeds or falls short of the economic costs. Putting non-economic benefits aside, is a national program of investment in college success a winner or a loser in purely economic terms? We recognize in embarking on such an effort that no precise or definitive answer to this question is possible. Our knowledge of "what works" in boosting college completion, while growing, is still incomplete. The future payoff to greater investments in education is not known with certainty, even though education has in the past always had a positive return, and the payoff is as high now as it has ever been. Some people claim that we are already educating nearly everybody who can benefit, but that claim is dubious in light of the fact that a number of other countries now have a larger fraction of their younger cohorts completing college than the United States does.

Despite these unavoidable uncertainties about the analysis, the Commission judged that a well-informed effort to estimate how the costs and benefits of a systematic program of investment in improved college completion would pay off over time was worthwhile. To develop this study, the Commission turned to Moody's Analytics, an economic consulting and forecasting firm headed by Mark Zandi. The details of their assumptions and findings are spelled out in the pages that follow, but it may be helpful here to provide an overview of the setup and conclusions.

The basic framework is one in which systematic investments are made in improving graduation rates (at both the associate and baccalaureate levels). The assumption is that the investments will result in increasing by 50 percent the graduation rates of students who now are in the bottom half of the distribution of institutional graduation rates and increasing the graduation rate of those in the top half by a somewhat smaller percentage. The model assumes that improvements will be phased in over a ten-year period during which graduation rates gradually improve. For example, an institution with a 40 percent graduation rate would improve to a 60 percent graduation rate over a decade. (Note that a program of this kind will be especially valuable for low-income and minority students, who disproportionately attend institutions with low completion rates.) Because of uncertainty about how expensive reaching this result would be, Moody's analyzed two sets of assumptions: first, that costs would rise by 50 percent per student to achieve the improvement in completion; and, second, that they would only need to rise by 25 percent. These numbers appear to be broadly consistent with the experience of programs like ASAP at CUNY or the intensive advising program at Georgia State University that succeed in raising program completion rates substantially.

The costs of this program are borne mainly during this initial investment period, when some combination of public and private funding must pay the cost and when a larger number of people are out of the workforce attending college. Thus, at the end of the ten-year investment period, the costs of the investment program substantially outweigh the benefits generated by the additional students who have completed their programs. But this picture starts to turn around as the productivity benefits of the workers who have completed their associate or baccalaureate degrees begin to grow. Younger students entering the workforce for the first time as college completers bring more education and higher productivity than the less educated workers who are retiring from the labor force. While for simplicity's sake the focus of the analytical model is on these younger students, the same logic applies to older adults deciding to return to (or begin) postsecondary education. Older workers who have left the labor market for more schooling come back to work earning more money (and producing more output) than before.

The analysis shows that beginning in the eleventh year of the program, the cost-benefit balance begins to turn around, and in every year thereafter output and earnings in the economy are higher than they would have been without the investment. Thirty years after the inception of the program, average wages in the workforce are estimated to be 3.1 percent higher than they would be without the investment, with the gains concentrated on those who would not have achieved degrees without the program. The program is projected at that time to have raised gross domestic product by 2.5 percent compared to a baseline, which projects recent rates of growth in completion. During the period from twenty to thirty years out, when the net benefits of the program are fully in place, annual GDP growth is about 10 percent higher

than it would be without the program (1.9 percent versus 2.1 percent). These benefits will continue well beyond 2040, with the net benefits of the program continuing to grow.

The particular quantities and dates generated by these estimates should not be taken too seriously, since they depend on strong assumptions, but the overall pattern of outcomes makes sense. In purely economic terms, a program of investment in higher education imposes net costs on the economy in the near term—costs that can be financed by government or private borrowing or by higher taxes. But as the education level of the workforce rises, so do earnings and output. After a number of years, the economy is more productive, and employment and GDP are larger than they would have been without the investment—large enough, in fact, to pay off the earlier borrowing or provide sufficient income to pay for the higher taxes.

This time pattern is familiar from physical infrastructure investments, that is, an upfront period of costly investment followed by a lengthy period of economic benefit. For example, the building of the Interstate Highway System in the 1950s and 1960s imposed considerable costs on the American economy as well as creating significant disruptions and dislocations during the construction period. But over time, as the system neared completion and then continued to be productive, the speed and reliability of travel both by car and very importantly by truck increased substantially, yielding economic benefits that far outweighed the costs. We can expect to see the same pattern again should we embark on new infrastructure programs like repairing the nation's bridges, improving urban transit systems, or combatting global warming through developing cleaner energy sources. And education investments are among the longest lasting in economic terms. A student taking a few years out of the workforce to earn a degree will typically receive an earnings benefit (and the economy will receive a productivity boost) that will continue for thirty or forty years—longer than most bridges or highways last.

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American Academy of Arts and Sciences

Executive Summary

There is strong evidence that raising the level of attainment of higher education degrees has historically yielded long-run economic and social benefits in the United States. Yet investing in greater educational success is costly, because it involves sending more students to college for longer periods of time, and because further investment may be needed to improve attainment rates. In this report, we present a simple model of the long-run economic costs and benefits of improving attainment by increasing completion rates.

Given the assumptions of our model, costs exceed benefits over a number of years, but economic returns later begin to kick in and eventually the program of investment yields a positive net economic return.

Currently, only 61 percent of first-time, full-time students at four-year colleges complete their college degree within eight years, which is twice the normal time. As a result of these low completion rates, one-quarter of thirty- to forty-year-olds who have attended some college, including both two- and four-year programs, have no degree.[1] A college degree provides a boost to earnings and employment, but much of the gains come from the completion of the degree. As a result, college dropouts forgo the majority of the benefits of higher education. Increasing college completion represents, in turn, an opportunity to boost earnings, lower unemployment, and expand the economy.

However, increasing college completion requires upfront costs. Those who dropped out of college chose to do so despite existing subsidies. As a result, encouraging current dropouts to stay in school for an extra year will likely exceed the current average cost of a year of college. Creating a precise estimate of this cost is difficult, as increasing completion may involve low-cost nudges, high-cost incentives, improvements in school quality, or some mix of the three. As a result, this analysis will not attempt to estimate the total costs of increasing completion, but instead will consider one possible scenario.

Moody's Analytics combined simulations of the U.S. Macro model with analysis using detailed micro-data-based models of education, earnings, and employment to compare the trajectory of the U.S. economy under two scenarios: a baseline in which the recent trajectory in educational attainment continues, and a scenario in which completion rates are significantly increased. The projections considered in this analysis assume that colleges at which the completion rate is currently below 50 percent will see their completion rates increase by half, while those with completion rates above 50 percent will see their noncompletion rates decrease by half.

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1. Census Bureau, Current Population Survey, Annual Social and Economic Supplement, 2016.

Under the baseline model, the share of the population with a bachelor's degree is expected to rise from 31 percent in 2016 to 40 percent in 2046, and under the higher completion scenario the share will increase to 46 percent. The rate of improvement in overall population attainment under the scenario is similar to the improvements in the last few decades. The attainment rate for associate's degrees is expected to rise from 10 percent in 2016 to 12 percent in the baseline model and to 15 percent in the scenario model. This is also consistent with past rates of overall improvement, albeit faster than in recent years. The recent slowdown suggests that improvements of a similar magnitude to the scenario model will be needed to return to past growth rates.

The direct effect of greater college completion will be to increase average earnings by 3.1 percent and, because college graduates are more likely to be employed, to increase employment by 0.5 percent. By 2046, total real GDP will be 2.5 percent larger than under the baseline. The labor market is also positively affected, with the unemployment rate 0.1 percentage point lower than under the baseline. The effect on total employment in the short run is negative, as more students enroll in school instead of working. In the long run, however, total employment is 0.5 percent higher, as more-educated workers have a greater likelihood of being employed.

This analysis assumes that the extra spending is financed via increases in government debt, rather than by increased taxes. Greater spending on higher education raises the deficit in the near term, with the negative impact peaking at $137.8 billion in 2025. However, the effect on the deficit begins to decline in 2026 as the employment effects turn from negative to positive and wage gains gradually accumulate. By the end of the forecast horizon, the deficit is lower under the higher-completion scenario. The increase in U.S. debt peaks at $1.9 trillion in 2041 but declines to $1.6 trillion by 2046, an increase of 2.6 percent compared with the baseline. Under a lower cost scenario, which was also examined, the increase in U.S. debt peaks at $1.4 trillion in 2041 and declines to $942 billion by 2046.

Increased earnings and productivity will expand the economy in the long run, translating to higher wages, employment, and GDP. However, using illustrative estimates of the likely costs, the net effect on the federal government deficit will be negative for some time.

Introduction

The economic performance of the United States has historically been tied to the education level of its population. Over the last hundred years, the U.S. population has steadily become more educated, with the average educational attainment increasing by about one year per decade. Economists estimate that this increase in human capital accounts for about 20 percent of overall growth in labor productivity over this time period.[2]

Yet it cannot be assumed that the process of expanding education that has prevailed for the last hundred years or so can continue indefinitely. High school attendance has been nearly universal for decades, and the high school dropout rate has fallen from 27.2 percent in 1960 to only 6.5 percent today, leaving less room for improvement than in the past. This puts greater importance on increasing college attainment. The good news is that the share of the population with a bachelor's degree is consistently increasing. The trend is also clear when focusing only on twenty-five-year-olds to abstract from demographic changes (see Chart 1).

However, not all past trends can be expected to continue. Although some commentators have declared that going to college should become as universal as K-12 education,[3] not every occupation requires a college degree, and not every person has the ability to get one or the interest to do so.

This raises important questions about the future of college attainment and the economy. If educational attainment is slowing, what will happen to the economy in coming decades? Conversely, what will happen to the economy if policy-makers are able to spur continued improvement in attainment rates?

This report will examine one particularly useful scenario: the effects of increasing college completion rates. The focus on completion is appealing, since it does not require encouraging people who otherwise would not choose to go to college. Instead, it concentrates on those who chose to go but did not finish. While there are necessarily limitations on increasing college enrollment, the room for improvement from current margins is clear: Only 61 percent of first-time students at four-year universities finish their degrees within 200 percent of the usual time to completion. For students at two-year programs, the completion rate is an even lower 21 percent. With only one-third of twenty-five-year-olds today holding a bachelor's degree, the question of whether "everyone should go to college" is irrelevant for the time being.

2. Claudia Goldin and Lawrence F. Katz, *The Race Between Education and Technology* (Cambridge, Mass.: Harvard University Press, 2009).

3. David Leonhardt, "Is College Worth It? Clearly, New Data Say," *The New York Times,* May 27, 2014.

Chart 1: Educational Attainment Grows

Percentage of the population age 25 with a bachelor's degree
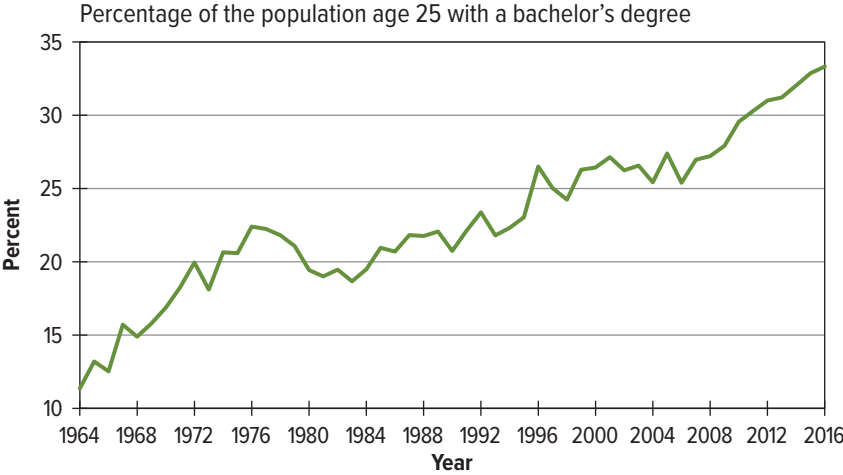
Sources: U.S. Bureau of Labor Statistics and Moody's Analytics

Projecting the Baseline

The first step in estimating the effect of higher attainment on the economy is understanding what will happen if current completion rates are maintained. This assumption is considered the baseline for this analysis. The good news is that even if college completion rates do not improve, overall educational attainment levels for the working-age population, ages eighteen to sixty-nine, will increase as older generations are replaced by younger generations with higher education.

The potential for higher attainment even under the status quo is illustrated in Chart 2, which shows educational attainment at specific ages for cohorts of different birth years. Those born in 1980 to 1984, for example, have a higher level of education in their mid-thirties than the 1950 to 1954 cohort did at that age. As older cohorts age out of the working-age population, this progress will result in higher overall attainment.

To estimate how much attainment will increase under the baseline, we first must project how much the most recent cohorts will achieve as they age. For example, we know that the 1980 to 1984 cohort is more educated than previous groups were in their mid-thirties, but what will happen as this cohort ages into the late thirties and beyond? To project this, we take the average growth in attainment for past cohorts for which we have data, and apply these growth rates to the most recent attainment rates for younger cohorts. For example, we know that 38 percent of people in the 1980 to 1984 cohort have a college degree at age thirty-three, the average age of this cohort in 2015. And we know from past cohorts that educational attainment usually goes up by around 0.5 percent at ages thirty-four, thirty-five, and thirty-six. From this we can project that attainment for the 1980 to 1984 cohort will progress to 38.5 percent, 39 percent, and 39.5 percent from ages thirty-three to thirty-six.

Chart 3 shows graphically how we are able to project attainment for each cohort in this way, with the dashed lines representing projected data and the solid lines representing the actual attainment to date. The baseline projections assume that for all cohorts born in 1995 and later, the life cycle of educational attainment looks like the attainment for the 1990 to 1994 cohort. In other words, the 1990 to 1994 cohort is as good as it will get under the baseline. As the analysis will later show, this assumption leads to a slowdown in the rate of improvement in the overall attainment rate compared with history (see Chart 9).

Chart 2: Rising Share with a Bachelor's Degree

Percentage of the population with a bachelor's degree, by age and birth year
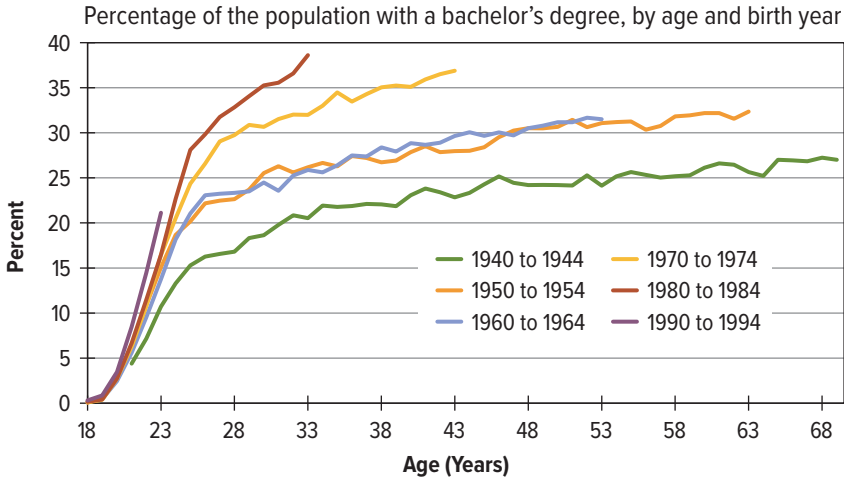
Sources: U.S. Bureau of Labor Statistics and Moody's Analytics

Chart 3: Projecting from Past Life Cycles

Percentage of the population with a bachelor's degree, by age and birth year
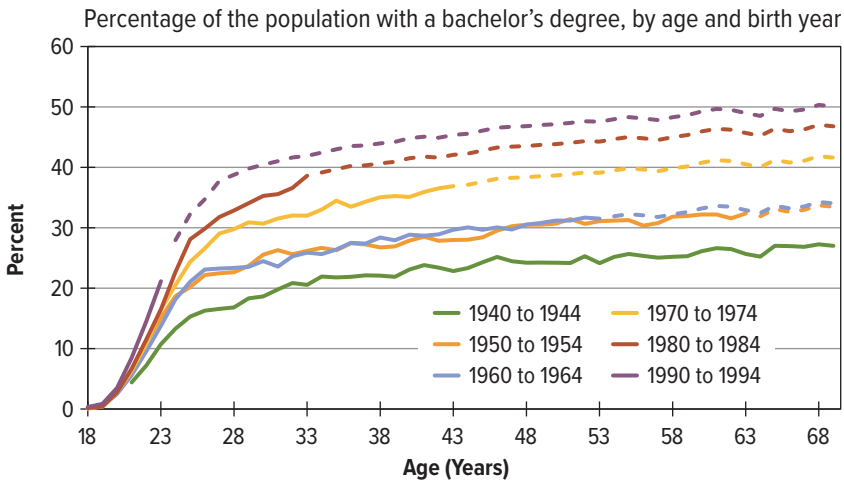
Sources: U.S. Bureau of Labor Statistics and Moody's Analytics

Increasing Completion Rates

Not everyone who enrolls in college graduates, and for many higher education institutions a surprisingly large share of students does not. This makes completion rates at two- and four-year institutions a plausible area for policy-makers to focus on in order to increase educational attainment.

The scale of the problem is apparent in College Scorecard data from the U.S. Department of Education, which show completion rates for all U.S. higher education institutions. At the worst-performing four-year colleges, only 23 percent of students finish their degrees.[4] For two-year colleges, completion rates in the worst performing group are only 9.8 percent. The gap between these worst-performing and best-performing schools is large: The top 5 percent of four-year colleges can boast 93 percent completion rates, and the top 5 percent of two-year schools have a 64 percent completion rate. Overall, 61 percent of first-time students at four-year universities finish their degrees within eight years, while 21 percent of students at two-year programs finish within four years.

Estimating precisely how much the completion rate could be improved with various policy levers is beyond the scope of the research. Instead, we simply model the effects of one possible scenario that will phase in over the next ten years. First, four-year colleges at which the completion rate is below 50 percent will see their completion rates increase by half, while those with completion rates above 50 percent will see their noncompletion rates decrease by half. For example, for the lowest completion rate group, this would amount to an increase in the completion rate from 23 percent to 35 percent (23% x 150% = 35%), while it rises in the highest group from 93.4 percent to 97.6 percent—a halving of the 6.6 percent noncompletion rate (see Chart 4). The same rule applies for associate's degree schools, and it also phases in over ten years (see Chart 5).

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4. This analysis focuses on 2,447 institutions that are primarily four-year schools and 891 primarily two-year schools. It excludes from the analysis the following institutions: non-degree granting, certificate-only institutions, graduate degree-only institutions, closed, and zero enrollment. Students used in the calculation of graduation rates are first-time, full-time students. An implied assumption of this analysis is that the effects on other students are similar.

Chart 4: Higher Bachelor's Completion Rates

Percentage completing a bachelor's degree within 8 years, by percentile

Overall completion rate from 61.4% to 77.6%

Legend: Actual (red), Scenario (blue)

Y-axis: Completion Rate (Percent)
X-axis: Groups of Baccalaureate-Granting Institutions

Low-Performing Institutions → High-Performing Institutions
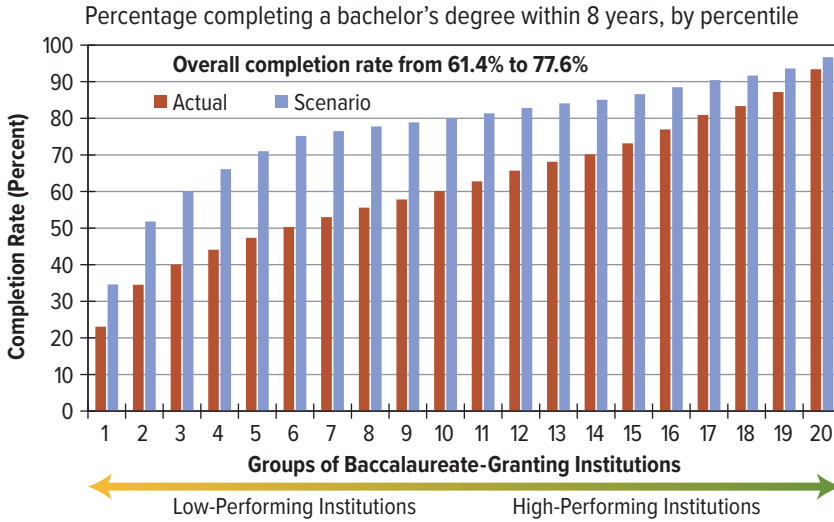
Sources: U.S. Department of Education and Moody's Analytics

Although this scenario is optimistic, it is important to note that these results could be achieved in two ways. First, completion rates could increase at some colleges. Second, more students can enroll in schools with higher completion rates and shift away from schools with lower completion rates. Recent efforts from the Department of Education have led low-performing for-profit universities to shut down, and research has shown that small nudges can push students into enrolling in better schools. For example, Caroline Hoxby and Sarah Turner show how at a cost of only $6 per student, high-ability, low-income students can be encouraged to apply and be admitted to more selective colleges.[5] Indeed, the College Scorecard data used in this analysis is an example of an attempt by the Department of Education to provide students with better information.

However, our scenario is not an attempt to examine the plausibility of increasing completion rates as much as proposed, but to examine the effects on the economy if such an improvement were achieved.

Whether through improvements in completion rates at specific schools or reallocation of students toward schools that already do better, the net effect of cutting average noncompletion rates in half would be to raise bachelor's completion rates from 61.4 percent to 77.6 percent, a 16.3 percentage point increase (see Chart 4).[6] This translates into a 26.5 percent (16.3% / 61.4%) increase in

5. Caroline Hoxby and Sarah Turner, "Expanding College Opportunities for High-Achieving, Low Income Students," Stanford Institute for Economic Policy Research discussion paper 12-014 (2013).

6. Because of rounding, 61.4 percent and 16.3 percent do not sum to 77.6 percent.

Chart 5: Higher Associate's Completion Rates

Percentage completing an associate's degree within 8 years, by percentile

Overall completion rate from 26.2% to 38.5%

■ Actual ■ Scenario

Y-axis: Completion Rate (Percent) — 0 to 90

X-axis: Groups of Associate's Degree-Granting Institutions (1–20)

Low-Performing Institutions → High-Performing Institutions
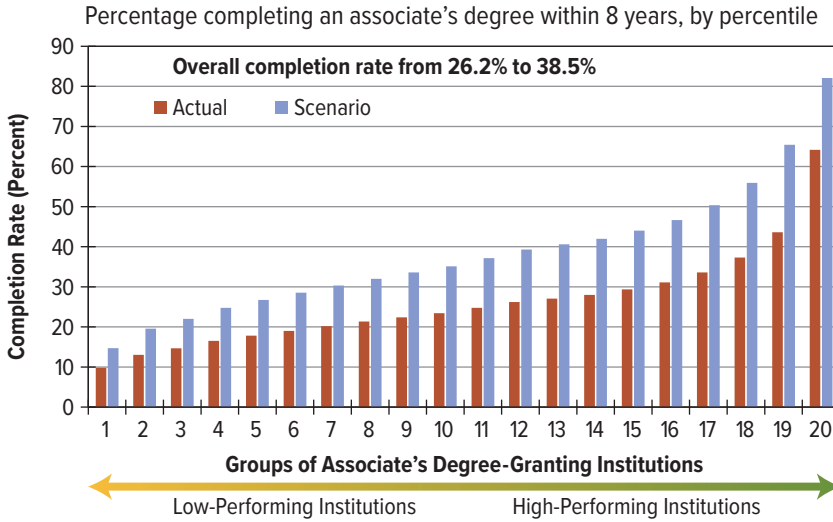
Sources: U.S. Department of Education and Moody's Analytics

the number of students in each age cohort with a college degree by the time the phase-in is complete. The scenario assumes that this effect is phased in over ten years, for an annual improvement rate of 2.4 percent (1.2651/10–1).

In addition, the scenario assumes the same changes for completion rates for students pursuing associate's degrees. As a result, average completion rates increase from 26.2 percent to 38.5 percent, or 12.4 percentage points (see Chart 5). This boost translates into a 47.3 percent (12.4% / 26.2%) increase in individuals with an associate's degree for each cohort by the time the phase-in is complete in ten years. Accordingly, the improvement rate climbs annually by 3.9 percent (1.4731/10–1).

An important effect of this policy is a likely increase in the college attainment of African-American and Hispanic students. These students disproportionately attend schools with low completion rates (see Chart 6). Therefore, the improvements at these schools would likely have a particularly notable effect on the completion rates of African-American and Hispanic students.

Chart 6: Minorities Disproportionately Affected

Percentage of enrolled minority students, by completion percentile
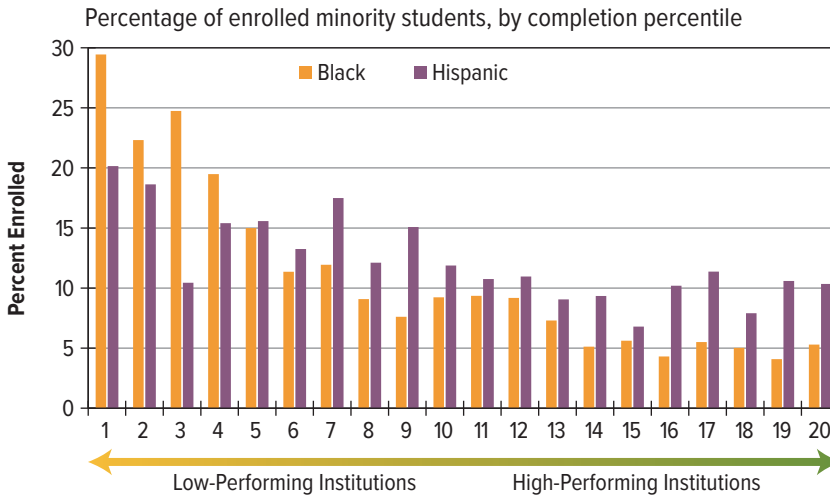
Sources: U.S. Department of Education and Moody's Analytics

From Completion to Attainment

To estimate the effect on the economy, the completion rates by cohort must be translated to overall population attainment rates. The improvement in completion rates is expected to be phased in over ten years, and to affect only people born in 1995 and later. The previous section estimated an annual improvement rate for four-year colleges of 2.4 percent, the annual attainment rate for each cohort is B_{ia} x $(1.024)^t$, where B_{ia} is the baseline attainment rate for cohort i at age a, and t is the number of years since 2016. This assumes that reforms have their first impact in 2017.

For example, the baseline projection presupposes that 32.2 percent of the cohort born in 1995 will have a bachelor's degree by age twenty-five. This group will reach age twenty-five in 2021,[7] by which time the policy will have been implemented for five years, increasing attainment rates by 25 percent ($1.024^5 = 1.125$). Therefore, the attainment rate for the 1995 cohort in 2021 under the scenario is 36.2 percent (32.2% x 1.125 = 36.2%).

Chart 7 shows the projected attainment rates for the cohort born in 2006, the first cohort for which the improvements are fully phased in for the entire adult life cycle. It is useful to note that the improvement in the decade from the 1995 cohort to the 2006 birth year is large, but of the same order of magnitude as the improvement from the 1960–1964 cohort to the 1970–1974 cohort.

A similar approach was taken regarding improvement in completion rates for associate's degrees (see Chart 8). Here the growth in attainment over the life cycle for the 2006 cohort is bigger than it has been historically. However, the high noncompletion rates at many associate's degree-granting institutions are consistent with the finding that there is much room for improvement.

The attainment rates for the baseline and scenario models are combined with Moody's Analytics forecasts of age-specific population projections from 2017 to 2046 to create an estimate of the total attainment rate for the eighteen-to-sixty-nine-year-old population (see Chart 9). Total attainment is expected to rise from 31 percent in 2016 to 40 percent in 2046 under the baseline and 46 percent under the scenario. The rate of improvement in overall population attainment is similar to the improvement to date. This is combined with employment-to-population ratios for each age group to estimate the attainment rate for the working population, ages eighteen to sixty-nine.

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7. Because attainment data are as of March of that year, it is assumed that age in a given year is equal to current year minus birth year plus one. For example, someone born in 1995 would be twenty-five years old by 2025 only if he or she was born before March 1995. Therefore, on average this cohort will turn twenty-five years old in 2026.

Chart 7: Higher Completion Scenario

Percentage of the population with a bachelor's degree, by age and birth year
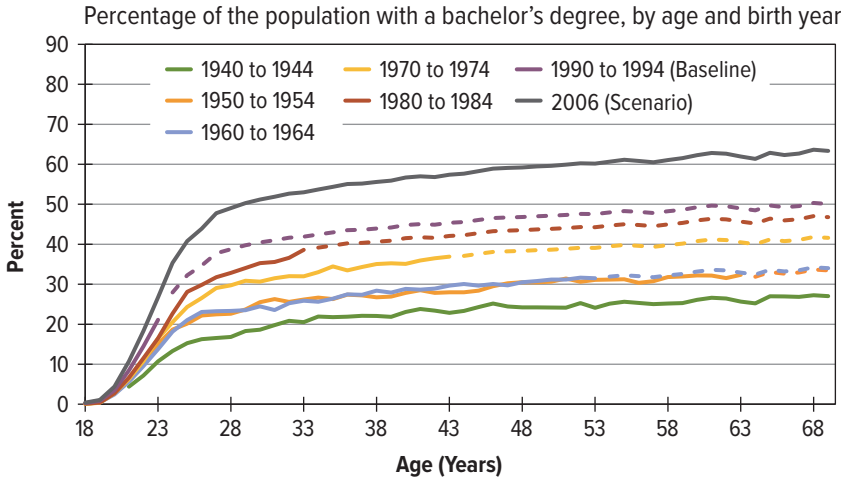
Sources: U.S. Bureau of Labor Statistics and Moody's Analytics

Chart 8: Higher Completion Scenario

Percentage of the population with an associate's degree, by age and birth year
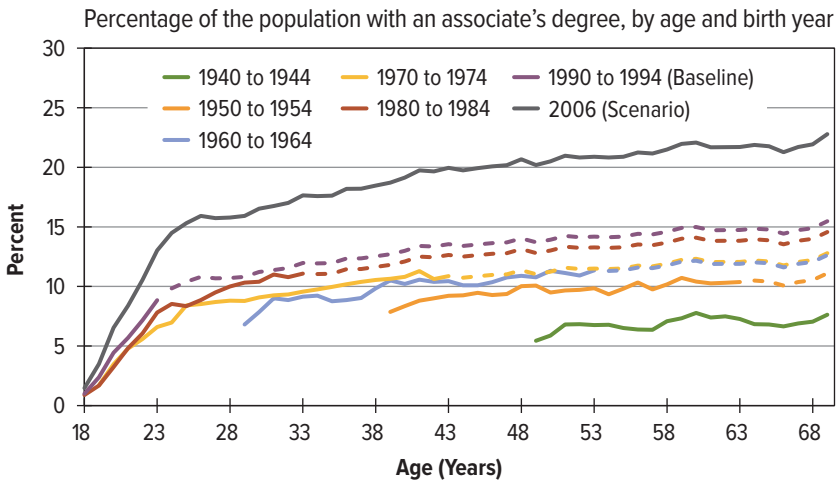
Sources: U.S. Bureau of Labor Statistics and Moody's Analytics

A similar approach is taken to estimate the attainment rate for associate's degrees. Here attainment is expected to rise from 10 percent in 2016 to 12 percent in the baseline and 15 percent in the scenario (see Chart 10). This is also consistent with past rates of overall improvement, albeit faster than in recent years.

Chart 9: Higher Overall Education

Percentage of the population age 18 to 69 with a bachelor's degree
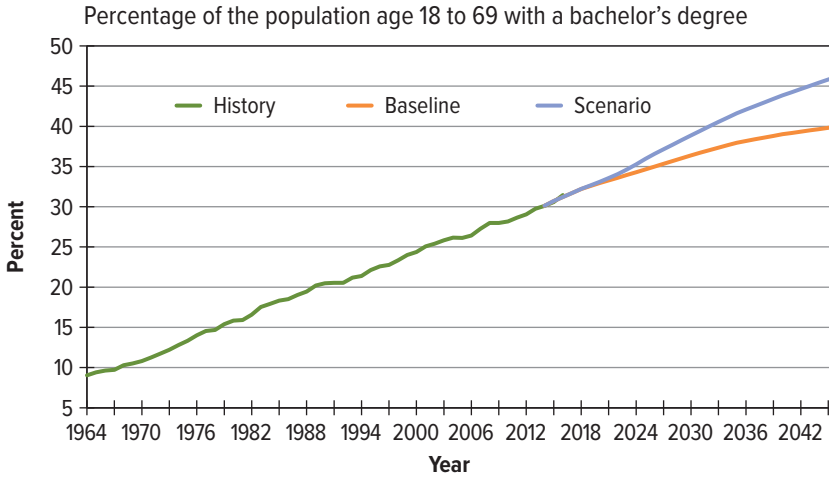
Sources: U.S. Bureau of Labor Statistics and Moody's Analytics

Chart 10: Higher Overall Education

Percentage of the population age 18 to 69 with an associate's degree
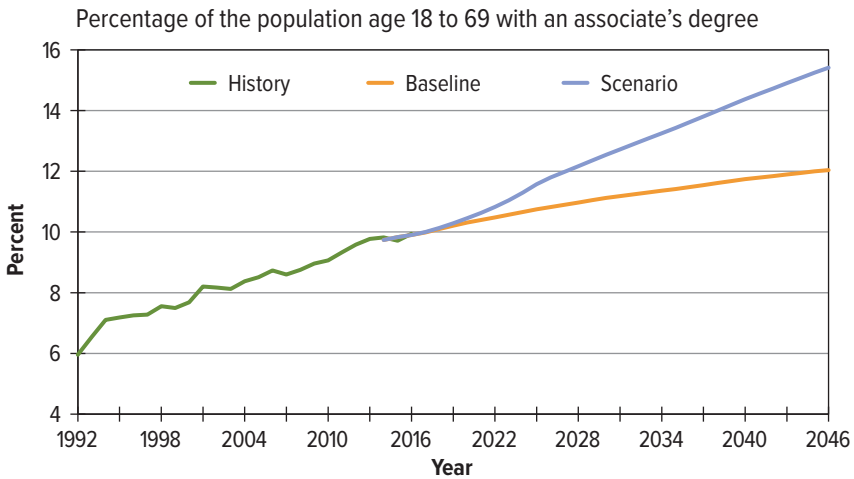
Sources: U.S. Bureau of Labor Statistics and Moody's Analytics

From Attainment to Earnings

Individuals with greater levels of education tend to work more, with both higher labor force participation and lower unemployment, and earn higher wages. But a potential concern with assuming that education leads to higher earnings is that higher innate ability is likely to cause both greater education levels and higher pay, meaning the observed correlation between education and earnings could be spurious. However, a large body of literature has established that education does indeed have a causal effect on earnings, and that this is due to higher productivity.[8] A bachelor's degree is estimated to increase wages between 20 percent and 48 percent.[9] Importantly, much of the individual gain from educational attainment comes from the completion of the degree, meaning that those who are, for example, three-fourths of the way toward a full degree do not receive three-fourths of the benefits. Wages of holders of a bachelor's degree are significantly higher than the wages of those who dropped out of college.

To estimate how much an individual gains from going from some college to earning a degree, we must compare the gains from completing a degree to the gains from dropping out of college without completing. Data on individual wages and education from the Current Population Survey are used in regression analysis to estimate the wage gains from completing college (see Appendix for details).

The same model allows imputation of the effect of an associate's degree (see Appendix Table). Here we compare the wage effects of an associate's degree to a high school diploma. Since associate's programs are two years long, many dropouts complete less than a full year of the program before they quit. In other words, "some college" is a less relevant comparison group given the short amount of time in the complete program.

Overall, we find that completing a bachelor's degree boosts earnings by 39 percent compared with some college, and an associate's degree boosts earnings and productivity by 10.6 percent relative to high school only.

8. David Card, "The Causal Effect of Education on Earnings," *Handbook of Labor Economics* 3A (1999): 1,801–1,863.

9. Douglas Webber, "Is the Return to Education the Same for Everybody?" *IZA World of Labor* (2014).

Finally, we capture the effect of education on probability of employment by estimating a similar model as the earnings regression, but use whether or not someone is employed as the dependent variable. Overall, a bachelor's degree increases the probability of having a job by 4.3 percentage points, and an associate's degree boosts it by 4.4 percentage points. However, while education increases the odds of employment overall, it decreases employment while enrolled in school. Using Current Population Survey data, the average decline in employment for those enrolled in college is estimated as a 12-percentage point decline. These two effects are combined with estimates of the increase in current enrollment and the increase in overall education attainment of the population to project the net effect on employment in a given year over time.

Assumptions and Caveats

Consistent with past research,[10] we interpret wage gains from completing a degree as primarily reflecting productivity differences. This is a necessary step in order for the effect on wages to translate into impacts in the wider economy. However, it is important to consider a few caveats to this analysis.

Although the regression models include occupational controls, it is possible that some of the wage effects may not represent actual productivity gains. For example, some of the gains to receiving a degree likely represent what is known as "signaling." In this case, the degree does not increase a worker's productivity, but rather informs potential employers of underlying innate ability levels that enabled job candidates to complete the degree. If the higher earnings college graduates receive are largely due to signaling, one concern is that increasing the number of degrees might not increase aggregate productivity in the economy, but merely allow those with degrees to take better-paying jobs that would otherwise have gone to workers without those degrees. This would make the social returns to education lower than the private returns.

The concern over signaling is mitigated for several reasons. First, while the debate is certainly not settled, the literature generally concludes that there is "little convincing evidence for an important role of Job Market Signaling."[11] Second, even pure signaling can actually lead to higher productivity by allowing better matching of employees to employers. Consider, for example, a hypothetical situation in which every job applicant is banned from disclosing any information on education and past work experience. Employers would have a much harder time finding the workers who best fit job requirements, and overall productivity would suffer. In this case, the signaling value of education and work experience information has a significant impact on productivity. In other words, signaling boosts productivity by helping to match the most-able workers to the job.

10. Dale W. Jorgenson, Mun S. Ho, and Kevin J. Stiroh, *Productivity, Volume 3: Information Technology and the American Growth Resurgence* (Cambridge, Mass.: MIT Press, 2005); Canyon Bosler, Mary C. Daly, John G. Fernald, and Bart Hobijn, "The Outlook for U.S. Labor-Quality Growth," National Bureau of Economic Research working paper no. w22555 (2016); Goldin and Katz, *The Race Between Education and Technology*.

11. Fabian Lange and Robert Topel, "The Social Value of Education and Human Capital," *Handbook of the Economics of Education* 1 (2006): 459–509.

In addition, if employers use the bachelor's degree signal as a minimum qualification for many positions, then more-educated workers do not crowd out less-educated workers even if the effect of the degree is purely signaling. In this case, a worker with a college degree gets a higher-productivity job that neither that worker nor a less-skilled worker previously could have taken. For example, while an MD degree may signal underlying ability, nobody is allowed to practice surgery without one. As a result, increasing the supply of medical doctors does not crowd out any less-credentialed workers and increases total productivity even in the implausible case in which the degree is pure signaling of prior ability.

Overall, we take the approach of past researchers and interpret the wage gains as productivity gains. We mitigate this somewhat by including occupational controls in some models. Although this measure is imperfect and likely includes some wage gains that do not translate into productivity, there are also spillovers from greater education that we leave out, including innovation and complementarities with lower-skilled workers. For example, Enrico Moretti estimates that a 1 percent increase in the share of college-educated workers in a city increases the wages of high school dropouts by 2.2 percent and high school graduates by 1.3 percent.[12] The approach of interpreting wage gains from education as productivity gains balances the risks of underestimating and overestimating the gains.

12. Enrico Moretti, "Social Returns to Education and Human Capital Externalities: Evidence from Cities," Center for Labor Economics, University of California, Berkeley, 1998.

Direct Aggregate Earnings and Employment Effects

Combining the estimates of the individual gains from completing bachelor's and associate's degrees with the baseline and scenario forecasts of attainment allows the estimation of direct aggregate earnings and employment effects. Because of the larger gains from a bachelor's degree, the effect is larger than for an associate's degree. By 2046, aggregate earnings are 2.7 percent higher because of a greater number of bachelor's degrees and 0.4 percent higher because of a greater number of associate's degrees, for a combined 3.1 percent increase.

The direct employment effects are also substantial, with a bachelor's degree increasing the odds of an individual being employed by 4.3 percent and an associate's degree increasing the odds of employment by 4.4 percent. However, initially employment is lower as more forgo working and enroll in school. As the positive employment effects eventually offset the negative enrollment effect, this translates to 0.3 percent and 0.2 percent increases in the employment-to-population ratio by 2046.

The Costs of College

Increasing college completion and attainment undoubtedly creates economic benefits, but as always in economics, there is no such thing as a free lunch. To measure the net economic impacts, the cost of greater college attendance must be included. Unfortunately, there is considerable uncertainty in this calculation and a precise estimate is beyond the scope of this analysis. Instead, a plausible cost will be selected to provide an illustration of the order of magnitude of costs. As will be discussed, actual costs could be significantly higher or lower. As a result, this analysis is a projection of what the benefits would look like if costs could be kept in this range, not a projection of what the net cost benefit will actually be.

On the one hand, college is already subsidized and young adults are choosing either to drop out of college or not attend at all. This suggests that additional subsidies may be required, and that the average cost to the government of educating these students could be significantly higher than the average cost of current students.

In addition, for many students, in particular those who will get an associate's degree rather than just a high school diploma, there may be issues of college preparedness. In order for more high school students to attend and complete college, better outcomes from K-12 schooling may be required to sufficiently prepare them. For these reasons, the full cost of increasing college completion could be higher than the current average student cost.

On the other hand, there is reason to think that low-cost nudges and reforms could also help increase college completion. This could be done by encouraging students to stay in school longer, and by encouraging students to apply to schools with higher completion rates. For example, the majority of high-ability, low-income students do not apply to more selective colleges even though they are likely to be accepted and the costs would be lower as a result of greater resources and financial aid for low-income students at selective colleges.[13] Experimental evidence has shown that low-cost nudges can help students enroll at more selective schools, which is one way to improve completion.[14] In addition, experimental evidence has shown that providing families with information on financial aid availability and helping them fill out federal student aid applications increased college enrollment at a cost of $88 per counseling session that in the end amounted to a cost of $1,100 per each child who ended up enrolling.[15]

13. Caroline Hoxby and Christopher Avery, "The Missing 'One-Offs': The Hidden Supply of High-Achieving, Low-Income Students," *Brookings Papers on Economic Activity* (1) (2013): 1–65.

14. Hoxby and Turner, "Expanding College Opportunities for High-Achieving, Low Income Students."

15. Eric P. Bettinger, Bridget Terry Long, Philip Oreopoulos, and Lisa Sanbonmatsu, "The Role of Application Assistance and Information in College Decisions: Results from the H&R Block FAFSA Experiment," *The Quarterly Journal of Economics* 127 (3) (2012): 1205–1242.

In addition, experiments suggest modest to relatively low-cost policies may help colleges increase completion rates. The Accelerated Study in Associate Programs (ASAP) at City University of New York was able to double the three-year graduation rates for associate's degrees using comprehensive academic and support services. The program also increased the share of students who transferred from associate's to bachelor's programs from 17 percent to 25 percent. The results were replicated for Ohio schools at an even lower cost.[16]

Overall, estimating the true cost of increasing college completion is a difficult task beyond the scope of this research. For the purpose of providing an illustrative estimate, we assume that the cost of an added year of school is 150 percent of the cost of a current year of college at a public university. To illustrate the importance of lower costs, an additional scenario is projected that utilizes the assumption that costs of an added year of school are 125 percent of current costs instead of 150 percent. In both scenarios, we assume an inflation-adjusted growth rate of 0.7 percent per year going forward.[17] Data from the National Council on Education Statistics places the 2013–2014 cost of a year at a four-year public school at $30,502, putting the cost of marginal students under the higher completion scenario at $45,754.[18] By 2046, the real cost of a year of college would rise to an inflation-adjusted $57,509.

Combined with projected increases in years of enrollment under the scenario compared with the baseline, this allows for the estimation of annual costs. It is assumed that the costs of additional enrollment would be paid for by a new federal program, and therefore the fiscal burden occurs at the federal level.

A risk to the projection is that costs of college escalate more quickly, or that the annual cost per student of bringing college completion rates up is more than 50 percent higher than the average cost of attending a public four-year university. Alternatively, the growth of per student costs could be lower than projected, making the projection too pessimistic.

16. Susan Dynarski and Meghan Oster, "Fulfilling the Promise of Community College: The ASAP Demonstrations," Brookings Institution (2016); https://www.brookings.edu/research/fulfilling-the-promise-of-community-college-the-asap-demonstrations/.

17. Data on the cost of college are from the National Council on Education Statistics. The growth rate is the average of the growth rates for private and public universities.

18. This does not include such costs to students as housing and food, which could be somewhat higher or lower as a result of college attendance but will generally accrue either way.

Macroeconomic Effects

The U.S. Macro model contains more than 1,800 variables, including unpublished intermediate variables, and is designed to produce forecasts that run thirty years. In addition to producing good cyclical near-term forecasts and stable long-run equilibrium, the model is designed to allow for scenario construction. To quantify the impact of the higher completion scenario on the U.S. economy, the Moody's Analytics model of the U.S. economy was simulated incorporating the estimated direct effect of greater educational attainment on the following variables: earnings, employment, and federal government spending (see Table 1).

As with the direct effects, the overall effect of higher completion on the economy accumulates slowly but has a significant and positive long-run impact. Greater productivity and employment translate to faster GDP growth. From 2036 to 2046, GDP growth will be 2 percent compared with 1.9 percent under the baseline. By 2046, total real GDP will be 2.5 percent larger than under the baseline. In addition, more productive workers translate to greater income, with median household income 3.5 percent higher in 2046 than under the baseline.

The labor market is also positively affected, with the unemployment rate at 4.9 percent, a 0.1-percentage point decline compared with the baseline. The effect on total employment in the short run is negative because more students are enrolled in school instead of working, which reduces labor supply. By 2046, however, total employment is 0.5 percent higher, as more-educated workers have a higher employment rate.

On the cost side, greater spending on higher education increases the deficit in the near term, with the negative impact peaking at $137.8 billion in 2025 (see Chart 11). Higher debt means greater interest payments, which also contribute to the deficit. However, the deficit begins to decline in 2026 as the employment effects turn from negative to positive and wage gains gradually accumulate, both of which increase federal government tax revenues. As a result of higher wages and employment and a larger economy, by 2043 the deficit is lower than it otherwise would be. The effect of higher costs of college is to increase total U.S. debt by a peak of $1.9 trillion in 2041. However, the debt begins to decline after this and ends up $1.6 trillion higher by 2046, an increase of 2.6 percent compared with the baseline.

Chart 11: Effect on Budget Deficit

Change in budget deficit under scenario, $ billion
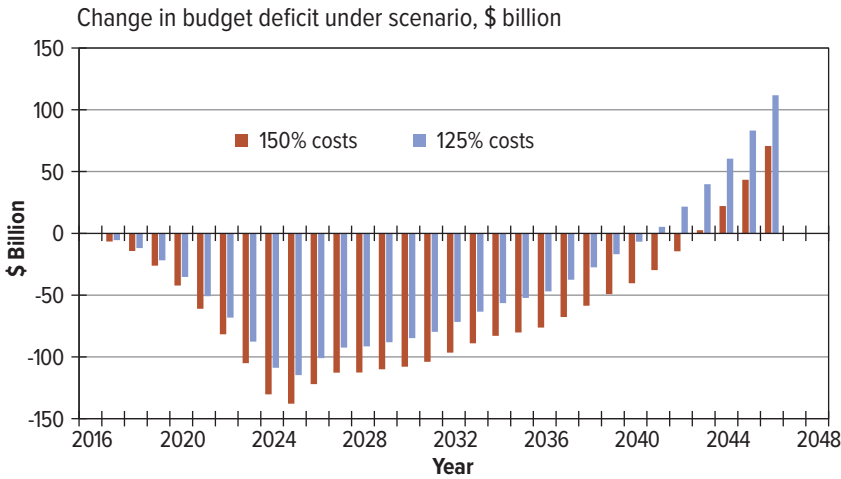
Sources: U.S. Bureau of Labor Statistics, U.S. Department of Education, and Moody's Analytics

The importance of the cost of increasing completion is made clear in an alternative scenario: the average cost of an additional year of school is equal to 125 percent of current costs instead of 150 percent. This does not appreciably change real GDP and employment. However, it does reduce the fiscal impact (see Table 2). By 2046, the federal debt grows by $942 billion instead of $1.6 trillion. The lower costs also reduce the debt to GDP ratio, which is projected to be 105 percent by 2046 instead of the 106.3 percent under the higher cost scenario. The peak increase in total debt is also lower, at $1.4 trillion in 2041 instead of $1.9 trillion.

Increasing educational attainment entails both costs and benefits. If the actual costs and benefits approximate the assumptions modeled in this analysis, the U.S. economy would benefit from higher wages and larger GDP, which eventually begins reducing the deficit. The size of the effect on debt depends on the cost of increasing completion for marginal students.

Table 1: Annual Difference Between Scenario and Baseline

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Real GDP (2009$ bil)	6.6	13.2	21.0	29.7	35.9	39.1	40.1	40.0	26.0	1.1	-4.4	7.6
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.1
Employment (mil)	0.0	0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	0.0	0.0	0.1
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Real median household income (2009$)	2.8	5.0	5.0	3.1	-0.9	-6.1	-10.9	-13.2	-12.8	-3.7	24.5	70.2
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Consumer price index (1980-82=100)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.4
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
S&P 500 stock index	0.3	0.1	-0.9	-2.8	-6.4	-10.9	-16.3	-20.7	-24.9	-26.0	-18.7	-5.1
% change	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	0.0	0.3	0.4
FHFA house price index	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.5	-0.7	-1.0	-1.3	-1.7
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
Unemployment rate (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal funds rate (%)	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2	-0.3
10-yr Treasury yield (%)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.0
Federal government debt ($ bil)	3.4	15.6	39.4	79.7	140.4	224.0	332.5	469.4	625.4	771.9	898.6	1,018.2
Debt-to-GDP ratio (%)	0.0	0.0	0.1	0.2	0.4	0.7	1.1	1.6	2.1	2.7	3.1	3.4
Federal budget deficit ($ bil)	-6.6	-14.3	-26.1	-42.2	-61.0	-81.7	-105.0	-130.3	-137.8	-122.0	-112.7	-112.5
Deficit-to-GDP ratio (%)	0.0	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4	-0.5	-0.5	-0.4	-0.4	-0.4
Government interest payments - federal ($ bil)	0.1	0.5	1.5	3.6	6.9	11.0	16.1	21.8	27.4	31.2	32.0	29.9
Interest-to-GDP ratio (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1

Table 1: Annual Difference Between Scenario and Baseline (*continued*)

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Real GDP (2009$ bil)	25.1	52.7	84.7	114.5	142.9	170.5	200.0	231.0	264.6	305.0	350.6	401.2
% change	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Employment (mil)	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Real median household income (2009$)	127.5	196.9	276.7	363.4	456.1	555.7	662.5	777.1	901.6	1,036.5	1,181.4	1,333.8
% change	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Consumer price index (1980-82=100)	-0.7	-1.0	-1.3	-1.6	-2.0	-2.4	-2.9	-3.5	-4.0	-4.7	-5.3	-6.0
% change	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
S&P 500 stock index	10.5	27.0	41.4	52.0	60.6	68.2	76.7	86.5	97.4	110.1	122.5	135.3
% change	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1
FHFA house price index	-2.3	-3.1	-4.2	-6.0	-8.3	-10.9	-13.5	-15.9	-17.9	-19.4	-20.6	-21.6
% change	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	0.0
Unemployment rate (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal funds rate (%)	-0.5	-0.5	-0.6	-0.6	-0.6	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8	-0.8
10-yr Treasury yield (%)	-0.1	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.5
Federal government debt ($ bil)	1,134.4	1,245.5	1,351.2	1,448.1	1,533.8	1,609.6	1,678.9	1,743.3	1,798.9	1,842.6	1,874.2	1,894.3
Debt-to-GDP ratio (%)	3.6	3.8	4.0	4.1	4.2	4.3	4.3	4.4	4.4	4.5	4.4	4.4
Federal budget deficit ($ bil)	-110.0	-107.9	-104.0	-96.6	-89.0	-82.9	-80.2	-76.2	-67.7	-58.6	-49.1	-40.4
Deficit-to-GDP ratio (%)	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1
Government interest payments - federal ($ bil)	25.5	20.0	14.0	8.0	2.1	-3.8	-9.8	-16.0	-22.5	-29.1	-36.2	-43.7
Interest-to-GDP ratio (%)	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1

Table 1: Annual Difference Between Scenario and Baseline (*continued*)

	2041	2042	2043	2044	2045	2046	Avg annual growth			
							2016–2020	2016–2026	2026–2036	2036–2046
Real GDP (2009$ bil)	453.6	507.3	564.7	624.4	684.3	738.1	0.0	0.0	0.1	0.2
% change	0.2	0.2	0.2	0.2	0.2	0.1				
Employment (mil)	0.6	0.6	0.7	0.7	0.8	0.9	0.0	0.0	0.0	0.0
% change	0.0	0.0	0.0	0.0	0.0	0.1				
Real median household income (2009$)	1,493.5	1,662.3	1,839.8	2,026.7	2,200.1	2,371.4	0.0	0.0	0.1	0.2
% change	0.2	0.2	0.2	0.3	0.2	0.2				
Consumer price index (1980-82=100)	-6.7	-7.5	-8.3	-9.1	-9.8	-10.3	0.0	0.0	-0.1	-0.1
% change	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1				
S&P 500 stock index	145.8	155.8	165.9	175.5	185.0	187.7	0.0	-0.1	0.3	0.1
% change	0.1	0.1	0.0	0.0	0.0	-0.1				
FHFA house price index	-22.4	-23.3	-24.3	-25.3	-26.0	-26.6	0.0	0.0	-0.2	-0.1
% change	0.0	0.0	0.0	0.0	0.0	0.0				
							Avgs			
Unemployment rate (%)	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
Federal funds rate (%)	-0.8	-0.8	-0.8	-0.8	-0.8	-0.7	0.0	0.0	-0.5	-0.8
10-yr Treasury yield (%)	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	0.0	0.1	-0.2	-0.5
Federal government debt ($ bil)	1,902.6	1,895.0	1,868.0	1,819.2	1,747.0	1,646.8	27.6	245.6	1312.1	1821.1
Debt-to-GDP ratio (%)	4.3	4.3	4.2	4.1	4.0	3.8	0.1	0.8	3.8	4.2
Federal budget deficit ($ bil)	-29.7	-14.5	2.6	22.1	43.4	70.6	-17.8	-66.1	-99.5	-18.0
Deficit-to-GDP ratio (%)	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.3	-0.1
Government interest payments - federal ($ bil)	-51.4	-59.4	-68.2	-77.7	-87.6	-95.5	1.1	10.9	12.1	-53.4
Interest-to-GDP ratio (%)	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	-0.1

Sources: U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, S&P, Federal Housing Finance Agency, U.S. Department of the Treasury, and Moody's Analytics

Table 2: Annual Difference Between Scenario and Baseline with 125% Costs

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Real GDP (2009$ bil)	5.5	11.2	17.9	25.2	30.5	33.3	34.1	34.2	22.9	3.0	-0.1	12.5
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.1
Employment (mil)	0.0	0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	0.0	0.0	0.1
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Real median household income (2009$)	2.7	4.9	5.3	4.1	1.4	-2.1	-4.8	-4.7	-1.5	10.3	39.8	85.8
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Consumer price index (1980-82=100)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
S&P 500 stock index	0.3	0.1	-0.7	-2.3	-5.4	-9.3	-13.8	-17.3	-20.4	-20.5	-12.8	0.6
% change	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.3	0.4
FHFA house price index	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5	-0.7	-0.9	-1.3	-1.8
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
Unemployment rate (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal funds rate (%)	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2	-0.3
10-yr Treasury yield (%)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Federal government debt ($ bil)	2.8	13.1	32.9	66.5	117.2	186.9	277.4	391.7	521.6	643.2	747.5	844.9
Debt-to-GDP ratio (%)	0.0	0.0	0.1	0.2	0.4	0.6	0.9	1.3	1.8	2.3	2.6	2.8
Federal budget deficit ($ bil)	-5.5	-12.0	-21.8	-35.2	-50.9	-68.2	-87.6	-108.7	-114.7	-100.9	-92.5	-91.4
Deficit-to-GDP ratio (%)	0.0	-0.1	-0.1	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3
Government interest payments - federal ($ bil)	0.1	0.4	1.2	3.0	5.7	9.2	13.3	18.0	22.4	25.1	25.1	22.3
Interest-to-GDP ratio (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1

Table 2: Annual Difference Between Scenario and Baseline with 125% Costs (*continued*)

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Real GDP (2009$ bil)	30.7	58.4	90.6	121.4	150.7	179.3	209.5	241.0	275.6	316.6	362.7	413.7
% change	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Employment (mil)	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5
% change	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Real median household income (2009$)	142.9	211.5	290.4	376.0	467.5	565.3	670.0	782.2	903.9	1,035.8	1,177.4	1,326.2
% change	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2
Consumer price index (1980-82=100)	-0.7	-1.0	-1.3	-1.7	-2.1	-2.5	-3.0	-3.5	-4.1	-4.7	-5.3	-6.0
% change	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
S&P 500 stock index	16.0	32.6	47.2	58.4	67.7	75.9	84.9	95.3	106.9	120.2	133.4	147.0
% change	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1
FHFA house price index	-2.3	-3.1	-4.3	-5.9	-8.1	-10.5	-13.1	-15.4	-17.2	-18.7	-19.8	-20.8
% change	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4	-0.3	-0.3	-0.2	-0.1	-0.1	0.0
Unemployment rate (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Federal funds rate (%)	-0.4	-0.5	-0.6	-0.6	-0.6	-0.6	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8
10-yr Treasury yield (%)	-0.1	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5
Federal government debt ($ bil)	938.3	1,025.8	1,106.9	1,178.5	1,238.6	1,288.2	1,330.3	1,366.4	1,392.8	1,406.9	1,408.1	1,396.9
Debt-to-GDP ratio (%)	3.0	3.2	3.3	3.3	3.4	3.4	3.5	3.5	3.5	3.4	3.4	3.3
Federal budget deficit ($ bil)	-88.1	-84.8	-79.7	-71.6	-63.4	-56.4	-52.2	-46.9	-37.6	-27.5	-16.9	-6.7
Deficit-to-GDP ratio (%)	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	0.0
Government interest payments - federal ($ bil)	17.5	11.4	4.8	-1.7	-8.2	-14.8	-21.4	-28.3	-35.5	-43.0	-50.8	-59.2
Interest-to-GDP ratio (%)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1

Table 2: Annual Difference Between Scenario and Baseline with 125% Costs (*continued*)

	2041	2042	2043	2044	2045	2046	2016–2020	2016–2026	2026–2036	2036–2046
								Avg annual growth		
Real GDP (2009$ bil)	466.7	521.5	579.8	640.5	701.2	755.8	0.0	0.0	0.1	0.2
% change	0.2	0.2	0.2	0.2	0.2	0.1				
Employment (mil)	0.6	0.6	0.7	0.7	0.8	0.9	0.0	0.0	0.0	0.0
% change	0.0	0.0	0.0	0.0	0.0	0.0				
Real median household income (2009$)	1,482.2	1,647.1	1,820.5	2,002.8	2,171.4	2,337.6	0.0	0.0	0.1	0.2
% change	0.2	0.2	0.2	0.2	0.2	21.01%				
Consumer price index (1980-82=100)	-6.7	-7.5	-8.3	-9.1	-9.7	-10.2	0.0	0.0	-0.1	-0.1
% change	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1				
S&P 500 stock index	158.4	169.4	180.7	191.3	201.9	205.6	0.0	-0.1	0.3	0.1
% change	0.1	0.1	0.1	0.0	0.0	-0.1				
FHFA house price index	-21.6	-22.5	-23.4	-24.3	-25.0	-25.5	0.0	0.0	-0.2	-0.1
% change	0.0	0.0	0.0	0.0	0.0	0.0				
								Avgs		
Unemployment rate (%)	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0
Federal funds rate (%)	-0.8	-0.8	-0.8	-0.8	-0.8	-0.7	0.0	0.0	-0.5	-0.8
10-yr Treasury yield (%)	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	0.0	0.1	-0.2	-0.5
Federal government debt ($ bil)	1,372.6	1,331.7	1,270.5	1,186.9	1,079.0	942.0	23.1	204.9	1064.4	1286.7
Debt-to-GDP ratio (%)	3.2	3.1	3.0	2.9	2.7	2.5	0.1	0.7	3.1	3.1
Federal budget deficit ($ bil)	5.3	21.6	39.8	60.5	83.1	111.8	-14.9	-55.0	-75.3	17.0
Deficit-to-GDP ratio (%)	0.0	0.0	0.0	0.1	0.1	0.1	-0.1	-0.2	-0.2	0.0
Government interest payments - federal ($ bil)	-67.7	-76.7	-86.4	-96.8	-107.5	-116.3	0.9	8.9	2.9	-69.8
Interest-to-GDP ratio (%)	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	-0.1

Sources: U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, S&P, Federal Housing Finance Agency, U.S. Department of the Treasury, and Moody's Analytics

Table 3: Baseline Forecast

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Real GDP (2009$ bil)	17,065	17,567	17,916	18,175	18,512	18,887	19,401	19,858	20,225	20,573	20,957	21,383
% change	2.4	2.9	2.0	1.4	1.9	2.0	2.7	2.4	1.8	1.7	1.9	2.0
Employment (mil)	146.6	148.6	150.2	151.1	151.4	152.1	153.9	155.5	156.4	157.0	157.6	158.5
% change	1.6	1.4	1.1	0.6	0.2	0.5	1.2	1.0	0.6	0.4	0.4	0.6
Real median household income (2009$)	52,037	52,514	52,861	53,147	53,366	53,689	54,178	54,660	55,086	55,486	55,937	56,443
% change	0.7	0.9	0.7	0.5	0.4	0.6	0.9	0.9	0.8	0.7	0.8	0.9
Consumer price index (1980-82=100)	246.8	253.0	260.5	267.6	274.1	280.2	286.5	292.9	299.4	306.2	313.3	320.6
% change	2.8	2.5	3.0	2.7	2.4	2.2	2.2	2.2	2.2	2.3	2.3	2.3
S&P 500 stock index	2,297	2,264	2,159	2,274	2,505	2,709	2,901	3,075	3,229	3,382	3,535	3,677
% change	9.8	-1.4	-4.7	5.4	10.1	8.2	7.1	6.0	5.0	4.7	4.5	4.0
FHFA house price index	396.1	406.9	410.3	415.2	426.5	442.1	461.3	482.6	503.8	522.8	540.2	557.0
% change	4.7	2.7	0.8	1.2	2.7	3.7	4.4	4.6	4.4	3.8	3.3	3.1
Unemployment rate (%)	4.6	4.4	4.4	4.8	5.2	5.3	4.7	4.3	4.4	4.6	4.8	4.7
Federal funds rate (%)	1.0	1.9	3.4	3.7	3.3	2.7	2.7	3.0	3.2	3.4	3.3	3.2
10-yr Treasury yield (%)	2.8	3.6	4.3	4.3	4.1	4.2	4.0	4.0	4.1	4.3	4.3	4.3
Federal government debt ($ bil)	14,822	15,928	16,889	18,043	19,296	20,470	21,681	22,814	23,799	25,001	26,291	27,623
Debt-to-GDP ratio (%)	76.4	77.7	78.7	80.9	83.2	84.8	85.9	86.6	87.0	88.2	89.2	90.1
Federal budget deficit ($ bil)	-725	-923	-1,061	-1,152	-1,186	-1,172	-1,165	-1,194	-1,293	-1,395	-1,475	-1,532
Deficit-to-GDP ratio (%)	-3.7	-4.5	-4.9	-5.2	-5.1	-4.9	-4.6	-4.5	-4.7	-4.9	-5.0	-5.0
Government interest payments - federal ($ bil)	568	716	859	924	970	1,006	1,045	1,094	1,147	1,197	1,245	1,292
Interest-to-GDP ratio (%)	2.9	3.5	4.0	4.1	4.2	4.2	4.1	4.2	4.2	4.2	4.2	4.2

Table 3: Baseline Forecast (*continued*)

	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Real GDP (2009$ bil)	21,798	22,207	22,632	23,064	23,507	23,962	24,422	24,881	25,348	25,827	26,314	26,814
% change	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Employment (mil)	159.4	160.3	161.2	162.1	163.0	164.0	165.0	166.0	167.0	168.1	169.3	170.5
% change	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7
Real median household income (2009$)	56,949	57,435	57,973	58,519	59,055	59,614	60,182	60,759	61,380	62,030	62,710	63,383
% change	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
Consumer price index (1980-82=100)	328.0	335.5	343.1	350.9	358.8	366.8	375.1	383.5	392.2	401.1	410.1	419.4
% change	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.3	2.3	2.3	2.3	2.3
S&P 500 stock index	3,816	3,965	4,132	4,295	4,467	4,647	4,836	5,034	5,248	5,471	5,710	5,956
% change	3.8	3.9	4.2	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.4	4.3
FHFA house price index	573.3	589.2	605.0	621.1	638.4	657.0	677.3	698.5	720.7	744.1	768.3	792.9
% change	2.9	2.8	2.7	2.7	2.8	2.9	3.1	3.1	3.2	3.2	3.3	3.2
Unemployment rate (%)	4.7	4.8	4.9	5.0	5.0	4.9	4.8	4.8	4.8	4.8	4.8	4.8
Federal funds rate (%)	3.1	3.1	3.1	3.2	3.2	3.3	3.3	3.3	3.3	3.4	3.4	3.4
10-yr Treasury yield (%)	4.3	4.3	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Federal government debt ($ bil)	28,976	30,359	31,782	33,245	34,732	36,225	37,724	39,341	41,061	42,834	44,712	46,758
Debt-to-GDP ratio (%)	90.9	91.7	92.4	93.0	93.6	93.9	94.2	94.6	95.1	95.5	96.0	96.7
Federal budget deficit ($ bil)	-1,598	-1,680	-1,779	-1,882	-1,972	-2,063	-2,168	-2,287	-2,419	-2,552	-2,689	-2,837
Deficit-to-GDP ratio (%)	-5.0	-5.1	-5.2	-5.3	-5.3	-5.3	-5.4	-5.5	-5.6	-5.7	-5.8	-5.9
Government interest payments - federal ($ bil)	1,342	1,397	1,455	1,515	1,578	1,645	1,717	1,793	1,876	1,965	2,061	2,163
Interest-to-GDP ratio (%)	4.2	4.2	4.2	4.2	4.3	4.3	4.3	4.3	4.3	4.4	4.4	4.5

Table 3: Baseline Forecast (*continued*)

	2041	2042	2043	2044	2045	2046	Avg annual growth			
							2016–2020	2016–2026	2026–2036	2036–2046
Real GDP (2009$ bil)	27,322	27,833	28,354	28,881	29,422	29,977	2.2	2.1	1.9	1.9
% change	1.9	1.9	1.9	1.9	1.9	1.9				
Employment (mil)	171.8	172.9	174.1	175.2	176.4	177.5	1.2	0.8	0.6	0.7
% change	0.7	0.7	0.7	0.7	0.7	65.37%				
Real median household income (2009$)	64,055	64,723	65,367	66,009	66,653	67,316	0.7	0.7	0.9	1.0
% change	1.1	1.0	1.0	1.0	1.0	99.51%				
Consumer price index (1980-82=100)	428.9	438.6	448.6	458.6	468.9	479.4	2.8	2.5	2.3	2.3
% change	2.3	2.3	2.3	2.2	2.2	2.2				
S&P 500 stock index	6,224	6,512	6,803	7,103	7,421	7,743	2.1	4.9	4.1	4.4
% change	4.5	4.6	4.5	4.4	4.5	4.3				
FHFA house price index	818.2	844.2	871.1	898.4	926.0	954.2	2.3	3.3	2.9	3.2
% change	3.2	3.2	3.2	3.1	3.1	3.0				
							Avgs			
Unemployment rate (%)	4.8	4.8	4.9	4.9	4.9	5.0	4.6	4.7	4.8	4.8
Federal funds rate (%)	3.4	3.5	3.5	3.5	3.5	3.5	2.1	2.6	3.2	3.4
10-yr Treasury yield (%)	4.4	4.4	4.4	4.4	4.4	4.4	3.4	3.8	4.3	4.4
Federal government debt ($ bil)	48,820	51,056	53,496	56,177	59,100	62,225	15,960	19,351	31,936	49,598
Debt-to-GDP ratio (%)	97.2	97.8	98.7	99.8	101.1	102.5	78.0	82.3	92.0	97.7
Federal budget deficit ($ bil)	-3,007	-3,200	-3,398	-3,612	-3,812	-4,044	-904	-1084	-1803	-3078
Deficit-to-GDP ratio (%)	-6.0	-6.1	-6.3	-6.4	-6.5	-6.7	-4.4	-4.6	-5.2	-6.0
Government interest payments - federal ($ bil)	2,272	2,387	2,510	2,641	2,780	2,937	708.0	909.0	1,470.5	2,307.7
Interest-to-GDP ratio (%)	4.5	4.6	4.6	4.7	4.8	4.8	3.4	3.8	4.2	4.5

Sources: U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics, S&P, Federal Housing Finance Agency, U.S. Department of the Treasury, and Moody's Analytics

Conclusion

As a greater share of the U.S. population has earned a college degree over time, one might expect the value of a degree to have fallen sharply. However, the supply of educated and skilled labor has been matched by a rising demand. As a result, the best estimates indicate that the returns to education remain high. This result is consistent across a variety of econometric studies, including those that focus on improving completion rates. Yet despite these returns, only one-third of twenty-five-year-olds had a bachelor's degree or higher in 2016.

There are a variety of policy levers to raise college attainment, but increasing completion rates represents an important area for improvement. Many students who pursue a degree do not graduate. Only 61 percent of first-time students at four-year universities finish their degrees within 200 percent of the usual time to completion. Only 21 percent complete associate's degrees within four years. While the particular policies that are best suited to increasing attainment are beyond the scope of this report, they would likely include a mix of higher completion rates at some colleges combined with an increase in the number of students who elect to attend colleges that already have higher completion rates.

The significant returns to education mean that if the costs of increasing completion can be kept in check, the benefits are likely to exceed the costs in the long run. At an individual level, David Autor estimates that after accounting for the effects on higher wages and the costs of a degree, the net lifetime gain from college for a man is currently $590,000 and for a woman $390,000.[19] However, the gains from education accrue over a lifetime of working. Initially, increasing college completion leads to higher fiscal spending and lower employment. For this reason, the fiscal costs of improving the college attainment rate of the population will exceed the fiscal benefits for the first decade under the most plausible assumptions.

These projections are not without significant risks and caveats. First, the analysis assumes a modest cost of college for targeted students as well as a modest growth in the cost of college. The costs and methods for inducing many additional students to complete their higher education are unknown. Success could necessitate significantly higher costs and could prove more difficult than the modest assumptions used in this analysis. Therefore, the costs of implementing such a program could outweigh the benefits derived in this study. Alternatively, the costs could be lower than assumed and therefore the net benefits would be greater. A careful analysis of these costs is beyond the scope of this research, and the cost estimates included illustrate the net benefits that could accrue if such costs could be achieved rather than a projection of the actual costs.

19. David H. Autor, "Skills, Education, and the Rise of Earnings Inequality Among the 'Other 99 Percent,'" *Science* 344 (2014): 843–851.

In addition, while marginal students gain from college completion, as an increasing share attend and earn degrees, college preparedness could become an issue that risks undermining the returns to higher education.

Finally, the wide variation in completion rates at colleges is likely matched by a wide variation in the returns to education that they provide students. This suggests that not only educational attainment should be improved but educational quality as well. Without more attention to educational costs and quality, a positive net economic impact is not guaranteed.

It is also worth noting that there are benefits to increased educational attainment that are not captured in this model. For example, Enrico Moretti finds significant economic spillovers in the local economy from a more-educated workforce: A 1 percent increase in the share of college-educated workers in a city increases the wages of low-skilled workers.[20] In addition, some share of the higher educational attainment would likely include science, technology, engineering, and mathematics workers, which Giovanni Peri, Kevin Shih, and Chad Sparber find are an important driver of productivity growth in U.S. cities.[21] Positive effects on other outcomes such as health, crime, and quality of life are also ignored.

Higher education remains a potential path to a stronger economy, higher incomes, and even net fiscal growth. Improving college completion rates is one plausible way to increase attainment. Future research should investigate which policies are most likely to achieve this, and more precisely estimate the likely costs of doing so.

20. Moretti, "Social Returns to Education and Human Capital Externalities."

21. Giovanni Peri, Kevin Shih, and Chad Sparber, "STEM Workers, H-1B Visas, and Productivity in U.S. Cities," *Journal of Labor Economics* 33 (S1) (2015): S225–S255.

Appendix

Detailed Methodology

Current Population Survey data from IPUMS provide information on earnings, education, and age that allow us to estimate a Mincer equation, which is a regression model that explains an individual's earnings using demographic and economic variables.

$Ln(Y_i) = B1\ NonHS_i + B2\ SomeCollegeYears_i + B3\ Associate_i + B4\ Bachelor_i + B5\ Advanced_i + A\ X_i + e_i$

We use dummy variables to define educational attainment for those with less than high school (NonHS), associate's degrees (Associate), bachelor's degree (Bachelor), and advanced degrees (Advanced). For those with some college but no degree, we include a measure of the number years of school completed (SomeCollegeYears). We also include dummy variables for each single-year age group in the vector X_i that controls for differences in earnings due to age and experience.

A second model is estimated that includes controls for detailed occupations. This helps to reduce the bias in the estimates that come from capturing underlying ability differences versus changes in human capital by focusing on differences in earnings for people within the same occupation. If the differences in earnings between occupations are driven by unmeasured ability rather than by the differences in human capital attained through education, than this estimate will be less biased by focusing on differences within occupation only. However, one of the important ways that education increases productivity is by allowing entry into higher-skill occupations. To balance the risks of over- versus under-controlling, we average the results from the models with and without occupation controls (see Appendix Table).

Based on coefficients from those models, we can estimate the higher earnings that result from going from some college to completing a bachelor's degree. On average, those with some college have completed 2.6 years of college. By comparing the coefficients B2 and B4, we can estimate the change in earnings that can be expected from going from 2.6 years of college to earning a degree. Specifically, we can estimate that it is B4 - (2.6 x B2).

Table: Earnings and Employment Models

Variable (first row: coefficient; second row: p-value)	Earnings model 1	Earnings model 2	Avg earnings model	Employment model 1	Employment model 2	Avg employment model
Less than high school	-0.231	-0.205	-0.218	-0.103	-0.011	-0.057
	0.000	0.000		0.000	0.000	
Yrs of college for those with some college	0.036	0.024	0.030	0.016	0.000	0.008
	0.000	0.000		0.000	0.000	
Associate's degree	0.136	0.083	0.109	0.082	0.006	0.044
	0.000	0.000		0.000	0.000	
Bachelor's degree	0.475	0.309	0.392	0.116	0.013	0.065
	0.000	0.000		0.000	0.000	
Advanced degree	0.654	0.431	0.542	0.144	0.007	0.076
	0.000	0.000		0.000	0.000	
Constant	5.479	6.040		0.329	-0.000	
	0.000	0.000		0.000	0.001	
Adjusted R-squared	0.629	0.680		0.803	0.929	
Sample (2014–2016)	503,363	503,363		852,267	852,267	
Dependent variable	ln(earnings)	ln(earnings)	ln(earnings)	Employed = 1	Employed = 1	Employed = 1
Age fixed effects	X	X		X	X	
Occupation fixed effects	X	X		X	X	

Source: Moody's Analytics

Contributors

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Michael S. McPherson is President Emeritus of the Spencer Foundation. Prior to joining the Foundation in 2003, he served as President of Macalester College in St. Paul, Minnesota, for seven years. A nationally known economist whose expertise focuses on the interplay between education and economics, McPherson spent the twenty-two years prior to his Macalester presidency as Professor of Economics, Chairman of the Economics Department, and Dean of Faculty at Williams College in Williamstown, Massachusetts. McPherson, who is co-author and editor of several books, including *College Access: Opportunity or Privilege?*; *Keeping College Affordable*; and *Economic Analysis, Moral Philosophy, and Public Policy*, was founding co-editor of the journal *Economics and Philosophy*. He has served as a trustee of the College Board, the American Council on Education, and the Minneapolis Institute of Arts. McPherson has been a Fellow of the Institute for Advanced Study and a Senior Fellow at the Brookings Institution. He was elected a Fellow of the American Academy of Arts and Sciences in 2014, and he co-chairs the Academy's Commission on the Future of Undergraduate Education.

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To address these topics and provide ideas for ensuring that individual Americans receive the education they need to thrive in the twenty-first century, the American Academy of Arts and Sciences, with generous funding from Carnegie Corporation of New York, established the Commission on the Future of Undergraduate Education. The Commission, which includes national leaders in education, business, and government, is studying how well students are being served by today's higher education models and identifying the challenges and opportunities that higher education will encounter in the decades ahead.

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