Making College Worth It: A Review of the Returns to Higher Education

Philip Oreopoulos and Uros Petronijevic

Summary

Despite a general rise in the return to college, likely due to technological change, the cost-benefit calculus facing prospective students can make the decision to invest in and attend college dauntingly complex. Philip Oreopoulos and Uros Petronijevic review research on the varying costs and benefits of higher education and explore in full the complexity of the decision to invest in and attend college. Optimal college attainment decisions are different for all prospective students, who diverge in terms of what they are likely to get out of higher education and what specific options might be best for them. Earnings of college graduates depend in important measure on the program of study and eventual occupation they choose. Students uninterested in or unable to complete a four-year college degree appear to benefit from completing a two-year degree.

Prospective students may also face both financial constraints, which prohibit them from taking advantage of more education, and information problems and behavioral idiosyncrasies, such as reluctance to take on debt, which keep them from making optimal decisions about attending college. In their discussion of how student debt figures in the college investment, the authors note that some students borrow too little and, as a result, underinvest in their education. Carefully calculating the return on the college investment can help determine the "appropriate" amount of debt.

Students are more likely to benefit from postsecondary education the more informed they are about the expenses associated with college and the potential options for financial aid, which can be extremely complex. To make the best college investment, Oreopoulos and Petronijevic stress, prospective students must give careful consideration to selecting the institution itself, the major to follow, and the eventual occupation to pursue. For any particular program at a particular school, anticipated future labor market earnings, the likelihood of completion, the costs, and the value of any student debt must all be factored into the assessment.

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Pressure on young Americans to attend and complete college is high and rising. President Barack Obama sees college as an "economic imperative that every family in America has to be able to afford" and has set as a goal that by 2020, "America will once again have the highest proportion of college graduates in the world."[1] A quick search of the popular press reveals many of the standard economic arguments in favor of attending college. Recent articles in the *Washington Post* and *Education Week* report that adults with a college degree have much lower unemployment rates and higher lifetime earnings than do their peers who do not attend college.[2] But despite the clear economic—and noneconomic—benefits that college-educated adults enjoy, the cost-benefit calculus facing prospective college students today can make the decision to invest in and attend college dauntingly complex. While policy makers and parents continue to push the nation's youth to enter college, the cost of attending college is increasing and students are borrowing more than ever to finance the investment.[3] Moreover, students today are taking longer than their peers in past decades to complete a college degree, a fact that itself can complicate the decision of whether to attend college.[4] In this article we review research on the varying costs and benefits of higher education and explore the complexity of the decision to attend college.

We begin by explaining the classic theory that describes the decision to go to college, taking note of factors that complicate that decision. We then review evidence about the return to college and the economic benefits that college graduates enjoy, and discuss the causal effect of attending college on earnings. We emphasize that the relative returns to a college education are rising—in terms of earnings—but are not the same for everyone who decides to attend. Earnings differ widely depending on program of study and the eventual occupation one pursues. Next we explore what is behind the recent rise in the earnings of those who attend college. Like many others, we suggest that the increase has been driven largely by technological change, which has, in turn, increased demand for workers with skills that complement the use of new technologies. We then briefly address the intensifying debate over whether college acts merely as a signal of skill that already exists at school entry or whether it fosters new skills. Next we discuss the possibility of nonpecuniary benefits stemming from college. Returning to the economic benefits of the college premium, we examine how college completion and school quality affect the premium. In closing we discuss the costs of different levels of higher education and student debt and show that the cost of college is properly considered as a long-term investment. The article concludes with a final assessment on the college investment, given the evidence we have to date.

The Decision to Attend College

According to the classic investment theory that describes the decision to attend college, individuals weigh the returns of the college investment against the costs, both direct (such as tuition) and indirect (such as forgone earnings while in college).[5] According to the theory, if the difference between the benefits and the costs is larger than the present value of a prospective student's lifetime earnings without attending college, the individual would attend. If everyone were to follow this simple investment model, we could deduce that for those who make the decision to attend college, the present value of the benefits exceeds the costs and that the investment is optimal.[6]

Individuals, however, may not always achieve the optimal educational investment prescribed by this model. On the simplest level, because both the costs and benefits of college can differ tremendously from one person to the next, individuals may not know ahead of time exactly what their costs and benefits will be.[7] And recent studies have shed light on several factors that are missing from the model framework. The most obvious is the existence of credit constraints. The theory behind the model assumes that individuals can perfectly borrow against their future incomes and that they have no aversion to holding large amounts of debt. Over the past two decades, however, an increasing number of potential college students may have been pushed against their credit limits.[8] For example, one study of cohorts from the late 1990s and early 2000s found, even after controlling for cognitive achievement, family composition, race, and residence, that youth from high-income families were still 16 percentage points more likely to attend college than youth from low-income families.[9] Youths who are credit constrained will either underinvest in higher education, stopping their studies before it would be optimal to do so, or not invest at all. Students who take on college in the presence of credit constraints may also feel the need to combine work with their studies, thereby reducing the time, and perhaps commitment, available for schoolwork. Credit constraints seem to be a particularly plausible explanation for the increase in student average hours of work from 1993 through 2005. During this period there was a steady rise in the fraction of high school graduates combining work and school, as college prices continued to rise but sources of financial aid did not follow suit.[10]

Even in the absence of formal credit constraints, some individuals may be averse to holding debt. That is, even though prospective students would be able to borrow the amount they need to finance college, they may be unwilling to do so. A 2009 study of how debt affects school enrollment and career choices analyzed an experiment conducted by the New York University School of Law to test how entering students reacted to different types of financial aid.[11] The university randomly offered students one of two distinct options: loans and tuition waivers. For entering students who were offered a loan, the university agreed to repay the loan if the students accepted employment in the lower-paying legal public sector upon graduation. Entering students who were offered the tuition waiver were obligated to pay the tuition at graduation if they did not accept employment in the public sector. The two aid packages were equivalent in monetary value and differed only in that the students who were offered the loan were considered to be in debt while they were enrolled in the law school. The study found that students who had their tuition waived were more likely to enroll in the law school and, once there, were significantly more likely to take a job in the public sector. Most high school students have no experience with debt, and many want to avoid incurring thousands of dollars of debt, even though they may eventually reap a significantly positive net return from the investment.

The simple model of educational investment also fails to take into account the problem of incomplete information. Before prospective students enter college, they may lack information about their ability to succeed as college students, as well as about the financial aspects of additional schooling.[12] For such students, deciding to enroll in college is a risky investment, with an uncertain payoff. Recent research in this area recognizes the existence of an "option value" associated with attending

college.[13] Students who decide to take on an additional year of schooling are able to learn during that year about their prospects of success in college, about the costs of college, and about labor market conditions and future earnings prospects. They also gain the valuable option to act on that new information. Some students who enroll may learn that they would be better off by dropping out; some who do not enroll would have learned that they have the capacity to succeed in college. Because of the *sequential* revelation of information, the decision to invest in college should be viewed not as a one-time choice, but as a series of sequential drop-out or continue-forward decisions, each made after new information becomes available.[14] Since prospective students have the freedom to respond to new information and changing circumstances, framing the college decision from this perspective makes most students better off than in the hypothetical scenario where they would be required to commit to their pre-enrollment educational choices.[15]

Yet another reality that is overlooked by the simple investment model is the cost of navigating through a complex financial aid program—a cost that may be so high as to deter students from attending college. A recent experimental study of financial aid programs as obstacles to college attendance divided low-income families of prospective students who visited tax preparation centers into three groups.[16] In the experiment, the full-treatment group received help completing the Free Application for Federal Student Aid (FAFSA) form and was given information about financial aid eligibility and tuition prices for nearby colleges. The second group was given information on their eligibility and college tuition, and was encouraged—but only encouraged—to complete the FAFSA. The control group was simply given a brochure with basic information about college and financial aid. The experiment found that the students who received FAFSA assistance were 25 percent more likely both to enter, and to stay in, college than those who did not.

That a small intervention can make the difference between individuals going or not going to college confirms that not all prospective students follow the straightforward investment model when making the decision whether to attend college. Compared with the potential benefits of attending college, the relatively small barrier of navigating through a complicated financial aid form would not be expected to deter college attendance if individuals were making straightforward optimal investment decisions.

This discussion illustrates that optimal decisions are different for all prospective college students. Individuals differ in terms of what they are likely to get out of higher education and what specific options might be best for them. They may face financial constraints that prohibit them from taking on debt to take advantage of more education. And, even in the absence of debt concerns, they may face information problems and behavioral idiosyncrasies may cause them not to make optimal decisions about attending college.

The College Premium, Returns, and Measurement Issues

In this section we first describe recent trends in labor market earnings for workers in different occupations and with varying levels of educational attainment. Noting that college graduates tend to earn more, on average, than those with only a high school degree across all major occupation sectors, we then turn to a discussion of the causal effect of college on earnings.

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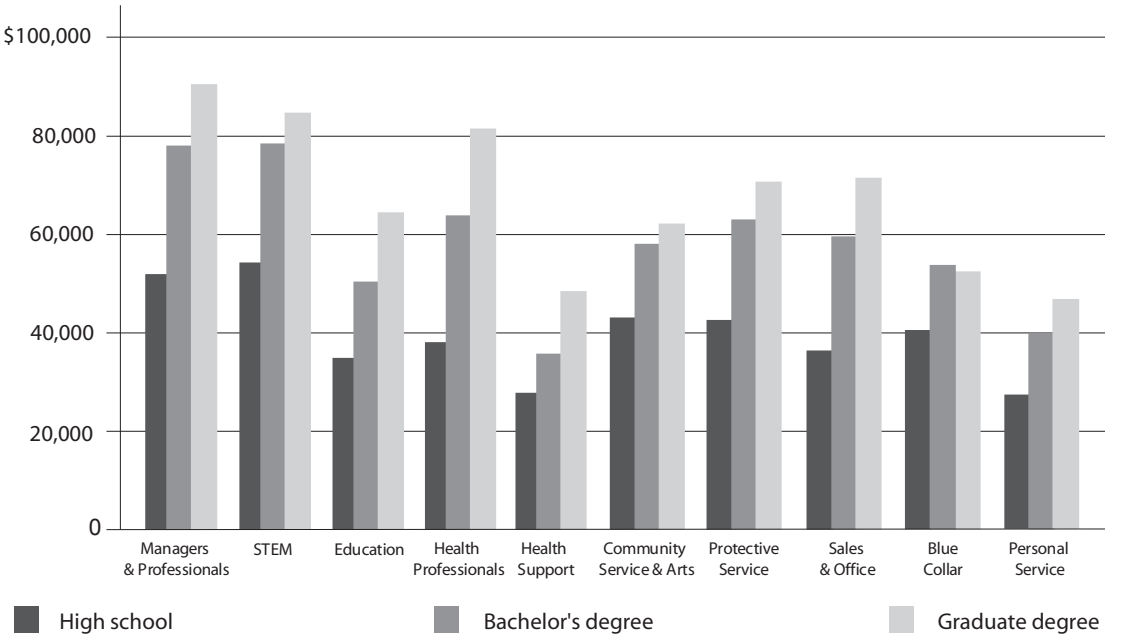
Descriptive Differences

It is well-documented that college-educated adults earn more than their high-school-educated peers and that the difference has been growing over the past few decades.[17] According to a study by the Georgetown University Center on Education and the Workforce, in 1999 an adult with a bachelor's degree earned 75 percent more over a lifetime than a high school graduate; by 2009 the premium had grown to 84 percent.[18] Another study estimated that, on average, a student graduating from college in 2009 would have lifetime earnings of about $1.2 million net of tuition expenses, compared with $780,000 for a high school graduate.[19] College graduates also enjoy higher employment rates. In November of 2011 the unemployment rate for college graduates was 4.4 percent, compared with 8.5 percent for high school graduates.[20]

Although college graduates generally earn more than those who have only high school degrees, their earnings nevertheless vary significantly across occupations. Median lifetime earnings for bachelor's degree holders are highest in the managerial, health professional, and science, technology, engineering, and mathematics (STEM) occupation sectors,[21] and lowest in the health support, education, and personal services sectors. The median lifetime earnings in 2009 for a bachelor's degree holder working in the STEM sector, for example, were a little over $3 million, compared with about $1.2 million for a peer in the health support sector. But although college graduates in health support earned much less than those in the STEM sector, they earned more than those with high school degrees only.

Figure 1 displays average annual earnings by occupation and education in 2010 for full-time workers, aged thirty to fifty, from the Current Population Survey.[22] As noted, average annual earnings are highest for college graduates (and for those with graduate degrees) in the managerial, STEM, and health professional sectors. Earnings for bachelor's degree holders are lowest in the health support, education, and personal service sectors. The earnings gaps between holders of bachelor's and high school degrees also differ across occupations. College graduates earned about 68 percent more on

Figure 1. Average Annual Earnings in 2010 by Occupation and Education



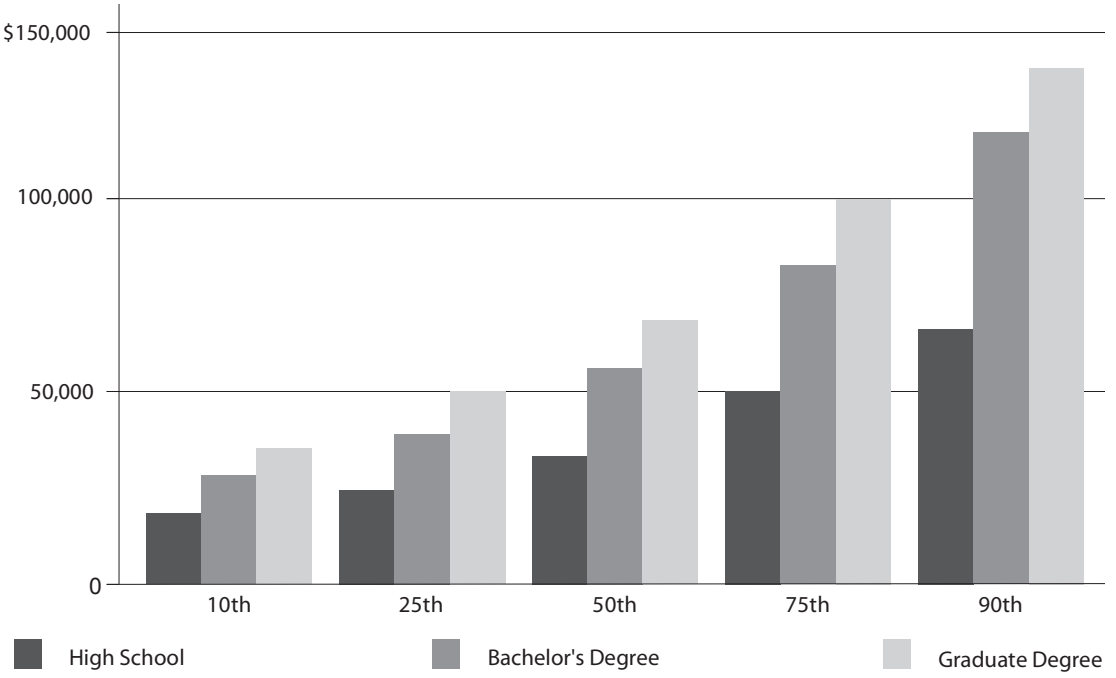
Source: Authors' calculations using the 2010 Current Population Survey Monthly Outgoing Rotation Groups.

Notes: The sample is restricted to full-time workers between ages thirty and fifty. Graduate degree consists of workers with master's and doctoral degrees.

average than high school graduates in the health professional sector, compared with only 27 percent more in the health support field, making it clear that both education *and* choice of occupation are important determinants of labor market outcomes and the return to college. Without necessarily indicating direct causal relationships, occupational differences in the earnings of those with and without postsecondary education are at least worth considering for prospective students contemplating the choice of college major and eventual sector of employment.[23]

Figure 2 provides a different perspective on the evidence by displaying the 10th, 25th, 50th, 75th, and 90th percentiles of the earnings distributions in 2011 for three different education levels (high school diploma, college degree, and graduate degree) among full-time workers aged thirty to fifty. Several points are worth noting. First, in the 50th percentile the annual earnings for high school graduates are about $34,000, compared with $57,000 for bachelor's degree holders. That is, at the middle of the earnings distributions in 2011, bachelor's degree holders earned about 67 percent more than those with only a high school education. The earnings differences increase for individuals in the 75th and 90th percentiles across each education category—the gap in average earnings between the highest college earners and the highest high school earners is substantially more than the gap between the lowest college and high school earners. By type of degree, the figure shows that although the premium to a bachelor's degree is high, that to a graduate degree is even higher. Some studies attribute a significant part of the rise in the overall college

Figure 2. Annual Earnings Percentiles in 2011 by Education



Source: Authors' calculations using the 2010 Current Population Survey Monthly Outgoing Rotation Groups.

Notes: The sample is restricted to full-time workers between ages thirty and fifty. Graduate degree consists of workers with master's and doctoral degrees.

wage premium to the increased earnings among workers with postbachelor degrees.[24]

In summary, a college education is associated with higher labor market earnings across all major occupation sectors. The link between college and higher earnings cannot, however, be interpreted as showing a causal effect of college attainment on earnings. The evidence presented in this section thus far should not lead readers to conclude that if any high school graduate went to college, he or she should expect to realize these labor market benefits. As we have noted, variations among individuals with respect to the costs of and benefits from college can be very large. Researchers often worry that those who stand to benefit the most from college are the students who decide to enroll, or that workers who would earn higher wages at *any* level of schooling often tend to acquire more schooling.[25] These concerns lead to the well-recognized problem of self-selection. Individuals *choose* whether to attend college; therefore, if those most likely to succeed in college are the ones who usually choose to attend, then having a college education does not necessarily explain their positive outcomes. Thus, encouraging more youth to attend college will not necessarily generate similar outcomes for them.

Explaining the Premium as a Causal Effect of Attending College

To address issues of selection involved in the college premium, researchers have exploited

natural experiments—for example, circumstances or policy changes that are beyond individuals' control—that cause one group to attend college more than another group. One such natural experiment compares youths who live within commuting distance of a college with others who do not. Youths who grow up near a college face lower costs of higher education and are more likely to attend than youths who have similar characteristics but live farther away. The conditions of this natural experiment enable researchers to estimate how much college proximity affects college attendance and, in turn, how much college proximity affects eventual earnings. Thus it is possible to estimate the average gain from college attendance for those for whom college proximity makes the difference between getting a postsecondary education and not getting it. One study using this technique in 1995 found that the earnings gain for each year of additional schooling ranged from 10 to 14 percent.[26]

Other studies have based a natural experiment on war veteran status and the GI Bill, a policy that induced some cohorts to obtain more college than others by providing financial aid and institutional support for war veterans who attended postsecondary institutions.[27] Using year 2000 census data, a recent study examined the returns to college based on use of the GI Bill by veterans of the Vietnam War.[28] This study exploited the initiation in December of 1969 of draft lotteries to determine conscription. As one would expect, being draft-eligible was highly correlated with Vietnam veteran status, but because eligibility was randomly determined, it was independent of unobserved ability factors that might influence earnings potential. Using variation in veteran status and the availability of GI Bill benefits to veterans, researchers were able to isolate variation in schooling that is driven by random draft-eligibility and not by unobserved individual factors. The study showed that randomly drafted veterans indeed finished more years of college and that, on average, each year led to an increase in earnings of about 9 percent. A related study analyzed the Canadian version of the GI Bill, the Veterans Rehabilitation Act, and found that an extra year spent in college improved earnings for veterans by about 15 percent.[29]

These estimates, which apply only to older cohorts affected by college proximity or draft lotteries several decades ago, are outdated. The share and types of students enrolling in college has since changed dramatically. More recent studies reflect the current population. One such study used a matching approach to estimate college returns for individuals with different predicted probabilities of completing college. Its nationally representative sample included individuals aged twenty-nine to thirty-two in 1994, thirty-three to thirty-six in 1998, and thirty-seven to forty in 2002.[30] The study used observable individual and family characteristics to calculate individual probabilities for completing college. It grouped individuals according to the different probabilities, so that those within each group had similar observable characteristics, on average. For each probability group, the researchers estimated the economic return to college completion. For both men and women, those who were least likely to complete college based on their observed characteristics benefited the most from completion. For example, for men with a 0–10 percent predicted probability of completing college, completion raised earnings about 30 percent; for those with a 60–100 percent predicted probability, it raised earnings only about 10 percent. This study, however, raises concern because it relies on the belief that, for those

with similar probabilities of completing college, reasons for actual attendance do not account for the differences in earnings.

A more convincing recent analysis on returns to college—specifically, for students on the margin of going to a four-year college—compares high school seniors from Florida who barely qualified to attend one of the state's public colleges with seniors who barely missed the academic cutoff.[31] Using data from the Florida State University System (FSUS) on seven cohorts of twelfth-grade students in high school graduating classes from 1996 through 2004, the study compares the earnings for those who barely crossed the grade threshold, and attended the university as a result, with the earnings for those who did not attend because they barely fell short of the threshold. The assumption is that those barely falling above or below the cutoff are for all practical purposes no different, on average.

The study looked at students who barely crossed the threshold at Florida International University, the school with the system's lowest admissions standards. Students who barely fell short of the cutoff typically did not attend an FSUS school, though they may have attended a community college or four-year college with lower acceptance criteria. The results are therefore interpreted as the gain marginal students experience by attending a four-year institution relative to those who do not attend that institution, but may attend a community college. The return to these marginal students from a year at a four-year college was about 8.7 percent—nearly identical to the returns experienced by the average Florida high school graduate. [32]

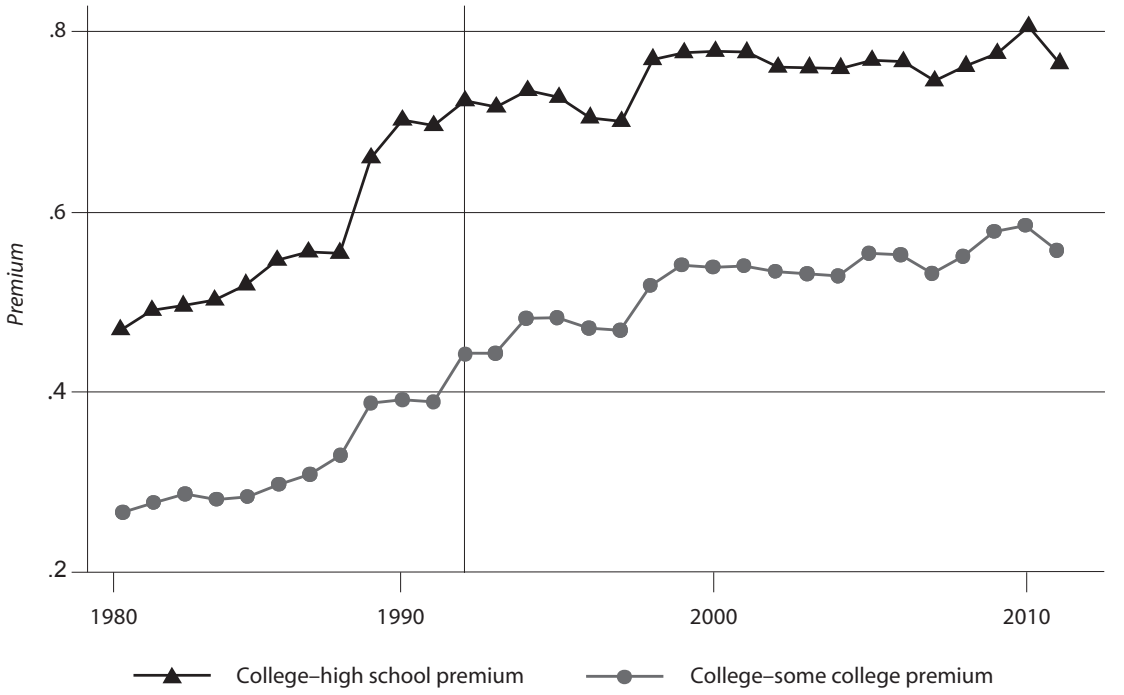
Other research has specifically looked at returns to two-year community colleges. A 1995 study using a sample of youths aged fourteen to twenty-one in 1979 found that the return for the average person to a year of community college was about 4–7 percent, compared with about 6–9 percent for a year of four-year college. [33] To provide a causal interpretation for their estimate, the researchers controlled for several variables that may be related to an individual's family background and ability.

A more recent study used detailed administrative data from Kentucky that tracked two cohorts of students who entered the state's community college system during the 2002–03 and the 2003–04 school years.[34] The researchers used changes in students' own education attainment to estimate that, on average, the earnings of high-school-educated women rose nearly 40 percent after they earned associate's degrees or diplomas, while men's earnings rose approximately 18–20 percent. Another 2011 study adopting a similar before-after comparison analyzed returns to two-year colleges for young adults between the ages of twenty-four and thirty in 2008.[35] Students who completed an associate's degree at a public or private college experienced an earnings gain of about 15–17 percent, or 8 percent for each year of education.

Explaining the Rise in the College Premium

In this section we seek the explanation for the remarkable rise in the college earnings premium despite an equally impressive increase in the number of students earning a college degree. Many economists have conjectured that growth in information technology over the past few decades has led to a general reorganization of the way that firms produce goods and services and a corresponding increase in demand for workers who have more abstract, multilevel, and noncognitive skills. One way to think of the

Figure 3a. The Evolution of the College Wage Premium

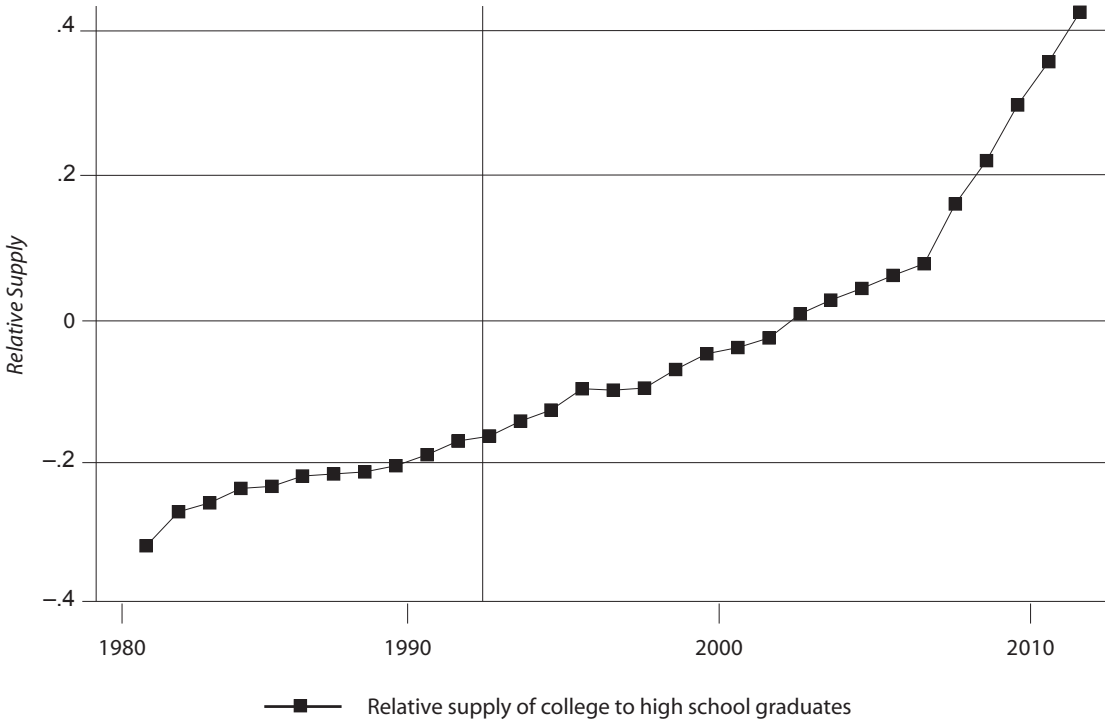


Source: Authors' calculations using the 1981–2011 Current Population Survey Monthly Outgoing Rotation Groups.

twin trends is as a race between the supply of skilled workers as proxied by educational attainment and the demand for skilled workers generated by the adoption of skill-biased technology.[36] Changes in technology are said to be skill-biased when they demand, or are especially complementary to, highly skilled workers.[37] Around 1980, demand for college-related skills started to outpace supply, and the gap has been widening ever since.[38] According to this argument, for the past three decades technological change has expanded demand for skilled workers, and because the supply of college-educated workers has not kept up with demand, employers have bid up the wages of college graduates, thereby raising the college earnings premium.

Figure 3 provides graphic evidence of this phenomenon for full-time workers who are thirty to fifty years old. Figure 3a shows the path of the wage premium for college graduates; figure 3b shows the path of the relative supply of college- and high school-educated workers. Relative supply is calculated as the proportion of workers who have a college degree or more, divided by the proportion who have only a high school diploma, minus one. Thus, relative supply is zero when the share of workers with a college degree is the same as the share of workers with only a high school diploma; it is positive when the share of workers with a college degree exceeds the share of workers with a high school diploma; and it is negative when the share of workers with a college degree is less than the share of workers with a high school

Figure 3b. The Evolution of the Relative Supply of College-Educated Workers



Source: Authors' calculations using the 1981–2011 Current Population Survey Monthly Outgoing Rotation Groups.

Notes: Sample consists of full-time workers between the ages of thirty and fifty. The college–high school premium is calculated as the average earnings for those with a bachelor's degree or more divided by the average earnings of those with only a high school degree minus one. The college–some college premium is calculated as the average earnings for those with a bachelor's degree or more divided by the average earnings of those with some college or an associate's degree, minus one. The year 1992 marks an important change in the education category definitions. After 1992 we use highest degree attained as level of education. Before 1992, those with exactly twelve years of completed education are classified as high school, those with more than twelve but less than sixteen are classified as some college, and those with sixteen or more are classified as college. The relative supply of college grads represents the proportion of workers with a college degree divided by the proportion with only a high school diploma, minus one.

diploma. Relative supply reveals how many more college-educated workers (in percentage terms) there are than workers with only a high school diploma. The figure shows that the college-to-high-school wage premium has been steadily increasing over the past three decades, peaking in 2010 at around 81 percent, and that the relative supply of college-educated workers has been steadily increasing at the same time. In 2010 there were about 36 percent more college-educated workers than workers with only a high school degree. The simultaneous growth of the relative supply *and* the wage premium suggests that growth in the relative demand for college-educated workers must have outpaced the growth in supply.

The past three decades have also witnessed an unusual and growing polarization in both employment and earnings. Employment opportunities and earnings have been rising both in high-education professional, technical, and managerial occupations and in

low-education food service, personal care, and protective service occupations while falling in middle-skill clerical, administrative, and sales occupations and in middle-skill production, craft, and operative occupations.[39] Leading explanations for these polarization patterns are the computer automation and offshoring of middle-skilled, routine tasks associated with bookkeeping, clerical work, and repetitive production, tasks once performed primarily by workers who had finished high school but not college.[40]

Understanding how technological advances increase the college premium may shed light on how college is valued in the labor market. If technological change increases relative earnings for college graduates, it likely does so by increasing the relative demand for their skills. Under this theory, college graduates have superior nonroutine, abstract skills that are useful for problem solving, multitasking, and creativity. Individuals with no more than a high school diploma, however, may still benefit from an increase in demand for manual skills that cannot be automated because job opportunities that require these skills have also expanded. However, because the qualifications necessary for performing manual tasks often do not extend beyond a high school diploma, there is a large potential supply of workers who can perform these tasks. As a result, demand and wages for low-skill occupations have increased faster than for middle-skill positions, but wage growth has not been as rapid for less-educated workers as for college graduates. Figure 3a illustrates this point, showing that the average earnings of college-educated workers have grown much more than the earnings of both high school graduates and those with only some college.

Embedded in the skill-biased technological change argument is the premise that there is an undersupply of college graduates today. Some have questioned this claim and countered that many workers with a bachelor's degree end up in jobs that do not require these credentials. In "The Undereducated American," a study conducted for the Georgetown University Center on Education and the Workforce, Anthony Carnevale and Stephen Rose explored this claim. They found that *within* occupations, individuals with a bachelor's degree almost always earn significantly more, on average, than those with only a high school diploma, even in the low-skilled occupation tier comprising labor, sales, operative, or service workers.[41] It thus seems not to be the case that an oversupply of college graduates is preventing these workers from benefiting from their credentials. If employers are acting rationally, then they must be paying for some added benefits that are associated with hiring college-educated workers. As noted, these added benefits likely represent the higher analytic and technical skills that college degree holders possess.

Another argument that could account for the rise in the college premium without relying on changes in technology that favor college is that a decline in average ability among high school graduates would also raise the college premium, without college training itself affecting earnings. As noted, the past few decades have witnessed an increase in college attainment rates, which affects the composition of both college and high school graduates. In order to expand enrollment, some colleges will presumably need to lower their admissions standards, which will result in students who previously would have been denied admission gaining acceptance. Because the average academic ability of the group of new entrants is likely lower than that of those who were admitted under the more stringent standards, the overall measure of

innate ability for college students may fall. Similarly, the new entrants were likely among the higher-ability members of the high school population, so by pushing these students into college, the enrollment expansion may reduce the measure of average ability of the leftover high school graduates. A significant drop in average high school graduate productivity levels may then account for the rise in relative earnings of college graduates. A 2010 study tests this claim by attempting to measure the rise in demand for college-related skills after controlling for shifts in initial high school and college graduate ability from 1960 to 2000.[42] The study compared individuals who were working in the same geographical region, but were born in regions with differing levels of college enrollment, to measure the extent to which workers among a larger pool of college graduates or a smaller pool of high school graduates were paid less. As noted, the intuition is that the average ability of college graduates is inversely related to the size of college enrollment, and employers will pay lower wages to less productive workers. The study concluded that the college wage premium would have been 6 percentage points *higher* in 2000, had college enrollment over the period not increased and caused a decline in the average quality of college graduates.[43] It can therefore likely be ruled out that cohorts of college graduates today are more able or that a drop in high school graduate ability is driving the rise in the college premium.

Signaling

An ongoing debate over the extent to which attending college improves students' skills has intensified recently with the release of *Academically Adrift: Limited Learning on College Campuses*, a book that presents extensive research showing that many undergraduate students do not actually demonstrate improved skills while in college.[44] With study time falling and faculty feeling pressure to pass as many students as possible, some observers wonder whether attending college develops new skills or merely signals the existence of skills acquired before entering college. Determining the extent to which each is true is proving frustratingly difficult.

We note here the subtle distinction between the signaling concern and the self-selection problem described earlier. Because students self-select into college, it may be that those who choose to pursue more schooling are the most likely to benefit from college or earn higher wages at any level of schooling. Despite the empirical challenges that self-selection poses, the assumption has been that students develop new skills throughout the college experience. According to the signaling hypothesis, however, students do not actually develop new skills as they move through college, but rather use a college degree to signal their innate ability to the labor market. If there is little or no skill development throughout college, and if skill-biased technological change is driving the rise in college earnings, then pushing students into college who do not already possess substantial abstract thinking skills will not necessarily lead to the returns described above.

Recent research on signaling focuses on how quickly employers learn about true skill. One study conducted in 2010, using data from 1979 to 2004 on individuals with either a high school diploma or a college degree, found that employers recognize from the start the ability of applicants coming out of college, but not the ability of those coming from high school.[45] As a measure of ability, the authors used each individual's Armed Forces Qualification Test (AFQT) score. To

test the signaling hypothesis, they reasoned that if an employer does not fully recognize an employee's ability initially, the relationship between AFQT score (which is correlated in part with unobserved ability) and wages should grow over time. As an employer learns about a worker's ability, he will pay accordingly, and as a result, the AFQT score should become more relevant in explaining wages as the worker's experience increases. Conversely, if an employer fully and immediately observes ability, then the relationship between AFQT and wages should remain constant over time because the employer will learn nothing further about unobserved ability.

Workers in the college labor market engage in a higher level of separation as they reveal their ability through grades that appear on transcripts, the major they complete, standardized test score results, and the name of the college from which they graduate.

The study found that the AFQT score for college-educated workers was closely related with wages from the start and that the relationship remained unchanged with experience; for high-school-educated workers the AFQT score became progressively more important in explaining wages. These findings suggest that employers know fully the skills of college graduates as soon as they enter the job market but that they need time to recognize the ability of high school graduates. That initial earnings within the pool of college graduates vary and that the variation is strongly correlated with proxies for individual ability suggest that college-educated workers are not simply separating themselves from those who have only a high school diploma. Workers in the college labor market engage in a higher level of separation as they reveal their ability through grades that appear on transcripts, the major they complete, standardized test score results, and the name of the college from which they graduate.[46]

That employers seem eventually to ascertain an employee's true ability for both college and high school graduates does not necessarily imply signaling is unimportant. In particular, this test for the importance of signaling comes into question if initial job placement affects not only one's wage level but also how one's wage changes over time. An employer may realize exceptional talents in a high school graduate within a year or two after she enters the job market, but if obtaining positions that offer more training or promotion opportunities depends on the first impression (or signal) that potential employers receive, it may be too late for her to follow these other, more lucrative career tracks. For example, being at a large firm or in a particular occupation immediately after graduation may allow her to realize wage growth that would not be possible if her career had a different starting point. In this sense, while the initial signal is important only for a brief period of time, it still may have long-lasting consequences.

Some college programs teach more specific skills than others. As noted, students who graduate from computer science, engineering,

and math programs have the highest estimated average lifetime earnings. Graduates with these degrees working in their fields are likely applying skills acquired from higher education. The signaling argument might be more convincing for workers who graduate from general arts or humanities programs. For them, the link between their occupational tasks and the skills they develop in college may be less evident. It is plausible that they already possessed the productivity employers value before entering college and that they simply use college to signal these skills to the labor market. But the absence of consensus on how much students learn in different college programs leaves the important role signaling may play over the long term yet to be determined.

Nonpecuniary Benefits from College

Although our analysis thus far has stressed the pecuniary returns to college, attending college has nonpecuniary benefits as well. College life itself offers more than classroom experiences. Students enjoy spending time in the company of others of their age, participating in clubs and sports that they would not easily have access to otherwise, and satisfying their intellectual curiosity. After completing college, students may be able to anticipate other nonpecuniary benefits both inside and outside of the labor market. For example, recent evidence shows that even after controlling for different measures of family background and income, workers with more schooling hold jobs that offer a greater sense of accomplishment, more independence and opportunities for creativity, and more social interactions than jobs available to noncollege graduates.[47] Several studies have also shown that college graduates tend to enjoy better health outcomes on average.[48]

The nonpecuniary benefits of attending college, like the pecuniary effects, are linked with personal characteristics such as family background. Any convincing study must isolate the effect of schooling alone. A second complication, specific to the analysis of nonpecuniary effects, is that more schooling tends to generate higher income, which itself affects certain aspects of individuals' lifestyles. Isolating the effect of schooling requires separating schooling from any effects stemming from the higher income brought about by more schooling.[49]

A 2011 study used two strategies to capture the causal effects of schooling on nonpecuniary outcomes.[50] The first used rich Norwegian administrative data to compare life outcomes between siblings with different levels of schooling. That approach helped control for differences in family background and, to the extent that the reasons underlying different levels of siblings' schooling are unrelated with later socioeconomic outcomes, provides a useful estimation strategy. Even after controlling for income, the study found that siblings with an average of one more year of education married spouses with more education, were less likely to be divorced or be receiving health disability payments, and were less likely to have a teenage birth. The second strategy used a natural experiment involving changes in compulsory schooling laws across the states. Because individuals have no control over how long they are legally required to be in school, any variation in schooling caused by changes in compulsory schooling is not likely to be related to unobserved individual characteristics. This strategy too revealed positive nonpecuniary benefits: individuals with more schooling were less likely to have a teenage birth, be divorced, suffer mental ailments, or have a child be retained a grade level.

Although credibly measuring these benefits is even more difficult than measuring economic rewards from college, it is important to recognize the potential for college to affect a wide array of outcomes over one's lifetime, not just through earnings.

The Importance of College Completion and School Quality

Researchers have explored how both completing a degree and attending an institution of high quality affect the college premium. In this section we document that, despite the existence of a significant earnings boost from completing college, completion rates have stagnated among recent cohorts as students are taking longer than before to complete a degree. Upon explaining some of the hypotheses that have been advanced to explain these trends, we close the section with a discussion of the impact on earnings from attending a highly selective school.

College Completion and the College Premium

Labor economists have long documented the existence of so-called "diploma" or "sheepskin" effects, which imply that the year of schooling in which individuals complete a degree is associated with an increase in earnings above the increase observed for each previous year.[51]

Put differently, over and above the number of years one attends college, possessing a college degree provides an additional boost to one's earnings. Early studies on diploma effects used years of education as a measure of schooling and then inferred degree attainment when the sixteenth year of education was complete. Although such inference may suffer from measurement error, the diploma effects for bachelor's degree recipients were on the order of 25 to 28 percent.[52] A 1995 study resolved much of the concern over measurement error by using accrued credit hours at a postsecondary institution as a measure of the quantity of education and adding separate measures for degree receipt. The estimates of bachelor's degree effects persisted, as the effects on annual earnings were estimated to be around 32.4 percent for men and 47.6 percent for women.[53]

Given the real costs associated with not completing college or prolonging time to completion, it seems puzzling that completion rates among recent cohorts have stagnated and that time to completion has risen. Researchers have advanced several hypotheses to explain this paradox.

First, it can be argued that if individuals are behaving optimally, some students *should* drop out of college. College can be thought of as an "experience good," the benefits of which are difficult to predict in advance.[54] Potential students differ in their ability to succeed in college and translate a college education into labor market earnings, and their individual-specific ability is not fully known before they enroll.[55] By attempting college, students can learn about their true ability and then act on this newly acquired information, deciding either to complete the program or to drop out. As noted, when the likelihood of success in college is initially uncertain, there is an "option value" to attending: receiving new information about true ability is certainly valuable, but it can only be obtained after enrollment. A 2009 study used unique survey data to explore the extent to which learning about true ability affects the decision to drop out of college.[56] The study found that at the time of entry, students tended to discount the possibility that they would perform poorly. After starting college, however, they updated their thinking to reflect their new insights

based on their experience in college, and the updating played an important role in the drop-out decision. As long as the time spent in college before dropping out is relatively short, one could argue that the benefit of acquiring new information—and having the option to act on it—outweighs the costs associated with failing to complete.

When the likelihood of success in college is initially uncertain, there is an "option value" to attending: receiving new information about true ability is certainly valuable, but it can only be obtained after enrollment.

To put the recent college completion trends into perspective, between 1970 and 1999 the college enrollment rates of students aged twenty-three who were pursuing a bachelor's degree rose substantially, but completion rates fell by 25 percent.[57] The completion rates of older groups, however, remained relatively stable, which suggests that the time it took individuals in this group to complete increased. We have already mentioned one possible explanation for these trends—financial constraints. Individuals who are unable to borrow or who have limited access to credit may be forced to work while in college, thereby extending the time required to finish a degree. Likewise, students may exhaust financial aid too quickly and be forced to put college on hold while they work and accrue more funds.[58]

Another hypothesis suggests that perhaps a decline in institution quality or a reduction in resources per student at public colleges and universities is to blame for the decline in completion rates. For example, a 2010 study that used data on the 1972 and 1992 high school classes reported that time to completion has increased most among students who start college at less-selective public universities and community colleges.[59] The idea is that students are taking longer to complete their studies not because of changes in their own preparedness or demographic characteristics, but rather because public colleges and universities are providing fewer resources per student. A 2007 study suggests that public colleges and universities do not fully offset increases in student demand for higher education with increases in resources.[60] Increased enrollment that is not accompanied by additional resources leads to increased time to completion through crowding and course enrollment constraints. Students in a particularly large cohort at a given institution may find it difficult to accumulate the required number and distribution of credits in an appropriate time frame. That increased time to completion seems to be concentrated at the least-selective institutions led another study to hypothesize that one way the top-tier schools avoid reductions in resources per student is by regulating enrollment size.[61]

School Quality and the College Premium

Research has investigated the extent to which attending a highly selective institution increases the college premium. The empirical challenge in answering this question is that students who attend top institutions may realize higher earnings regardless of where they attend school. To address the challenge, a 2002 study matched students who applied to, and were accepted by, similar colleges of

varying quality.[62] When the study analyzed the earnings differences between students who attended more selective institutions and those who were accepted by equally selective institutions but chose to attend less selective schools, it found no broad discernible earnings effect from attending a highly selective institution. The only significantly positive effects were concentrated among a subgroup of students from low-income families.

The 2002 study, however, is the exception in a large body of research that typically does find significant economic returns to school quality.[63] A 2009 study by Mark Hoekstra, for example, found that attending a flagship state university had large positive earnings effects for 28- to 33-year-old individuals.[64] It compared the earnings of students who attended the school after falling just above the academic admissions cutoff and students who were just below the cutoff and did not attend. Because picking students who fall just below or just above the cutoff is essentially equivalent to random sampling, there could be few systematic differences in unobservable characteristics between the two groups. The study found that attending the most selective state university causes earnings to be approximately 20 percent higher for white males. Although Hoekstra could not confirm that students who were rejected attended college elsewhere, he presented suggestive evidence that they did so. If the majority of these students did indeed attend another institution, the findings could be confidently interpreted as the effect of attending a flagship over another university.

In summary, researchers have found that both completing college and attending an institution of high quality increase the returns to attending college. A direct corollary of these findings is that state and federal policies aimed only at increasing access to higher education may not be enough to combat earnings inequality. As college enrollment rates have risen over the past few decades, but completion has not followed suit, policy makers have thus begun to place more emphasis on college completion.

Costs, Student Debt, and the College Investment

Having reflected at length about the benefits associated with college completion, we move on to consider how cost and student debt figure in the college investment.

Costs and the College Investment

Recent statistics provided by the College Board indicate that average annual tuition and fees for public four-year colleges are approximately $8,200 for in-state students and $20,770 for out-of-state students.[65] For the two groups considered together, the median annual tuition was $8,274 in 2011–12, with about 19 percent of students enrolled in institutions charging less than $6,000, and 8.2 percent in institutions charging more than $18,000 a year.[66] Costs at private four-year institutions average around $28,500. At private nonprofit four-year institutions, median annual tuition in 2011–12 was $29,242, with about 28 percent of students enrolled in institutions charging $36,000 or more a year. Finally, students attending public two-year colleges faced average annual tuition and fees of about $2,900.

Clearly costs vary widely across institutions, and discrepancies between public and private tuition figures are large. Costs to students also vary depending on how much financial aid each is eligible to receive. Net tuition fees are often lower than students think. One study, for example, reviews the literature and reports evidence suggesting that high school

students overestimated the tuition cost of public four-year institutions by 65 percent; their parents, by 80 percent.[67] Just as the benefits associated with college completion can be large, so can the payoff to properly researching both the costs of, and financial aid available at, each school.

The appropriate way to assess the cost of college is as an investment to be paid for over time. Just as with a housing property, the primary question is not the total price of the property, but whether the buyer can support mortgage payments over the long run with enough resources left over for other necessities.[68] Like the benefits of purchasing a house, the benefits of obtaining a college degree are spread over the long run—certainly much longer than the period a student is in school paying annual tuition fees. The basis for establishing acceptable levels of tuition fees and appropriate levels of debt financing is earnings expected after graduation.

Such an assessment would begin with the cost of tuition. An average student attending an in-state public four-year college or university in 2011 faced net tuition and fees estimated at approximately $2,490, once grant aid and federal education tax credits and deductions were taken into account.[69] Based on that, and not accounting for books and other supplies, the average tuition cost for a student who completes college in four to five years will be between $9,960 and $12,450. To cover these costs, suppose a student took out a loan which he was, upon graduating, required to repay in annual increments of $2,500 over ten years. In the case of debt financing, this repayment figure is the first piece of relevant information in evaluating the college investment. Another is the earned income expected upon graduation. Deciding whether college is a prudent investment requires comparing the difference between the hypothetical student's expected earnings as a college graduate and as a high school graduate, with the annual repayment figure. In 2010, workers with only a high school diploma earned $32,000 a year, on average.[70] Therefore, if our hypothetical student is likely to earn the average high school graduate income without attending college, his or her college earnings would need to be least $34,500 a year ($32,000 plus the annual repayment figure) to justify the college investment. That figure translates into 7.8 percent more a year more than the earnings of the average high school graduate. In 2010, bachelor's degree holders earned approximately $56,000 a year, on average, or 75 percent more a year than high school graduates. In this specific hypothetical scenario, going to college would cover the annual repayment figure and leave $21,500 in excess of annual high school earnings. Such an investment in college would clearly be a sound one. In fact, because the earnings premium of college continues beyond the ten-year repayment period, the investment could be considered optimal with an even lower level of expected college earnings.

The preceding exercise is a (simplified) demonstration of how to begin to assess the college investment. Of course, earnings after college are uncertain and any calculations need to be conducted using reasonable predictions of future earnings. In addition, as noted, costs vary for in- and out-of-state students, public and private institutions, and by whether a student is eligible for, or takes advantage of, financial aid. Annual tuition, and therefore repayment figures in the event of debt financing, can be higher or lower than the hypothetical example of $2,500 used above.

Student Debt and the College Investment

Student borrowing has drawn much media attention of late, including reports of staggering figures of student debt and stories of debt-burdened students unable to make loan repayments. How does student debt affect the college investment? Do students borrow too much or too little? A 2012 study by Christopher Avery and Sarah Turner addressed these questions.[71] As background, from 1989 to 2008 the total volume of federal student loans expanded sevenfold, although the average size loan per student remained fairly constant. The share of undergraduate students taking out loans increased from 19 to 35 percent over the same period. As we have shown, the college investment often comes with a high earnings payoff, and that payoff has markedly increased in the past few decades. The increasing return to college could justify an increasing willingness to borrow in order to reap the higher returns. It may actually be the case that some students borrow too *little* and do not obtain enough schooling.

When Avery and Turner analyzed total accumulated student debt six years after college enrollment from 2004 to 2009, they found that the median accumulated debt among students at public four-year institutions was $6,000. Among those who completed a bachelor's degree, the median was $7,500; the 90th percentile was $32,000. Less than half of a percent of graduating students, excluding those in the for-profit sector, had more than $100,000 of student debt. Among student borrowers who were in repayment six years after initial college enrollment, the average ratio of monthly repayment to income was about 10.5 percent.

The authors concluded that the popular media claim that levels of student borrowing are universally too high is simply not accurate. It may even be the case that some students borrow too little and that students may, as a result, underinvest in their education. We have already shown that some individuals are averse to holding debt and may avoid taking out loans, while others may avoid making use of popular federal aid programs because they are too complicated to use effectively. Ultimately, the manner in which college costs and student debt affect the value of the college investment depends on an array of factors, including individual- and institution-specific calculations involving variations in earnings by field of study and occupation, by whether students attend highly selective or less selective institutions, and by whether they finish their studies and earn a degree. All these factors must be taken into account to predict the return on the college investment and determine the "appropriate" amount of debt.

Conclusion

What factors should prospective students consider before investing in college? Most studies that examine the causal impact of college on earnings find an average college premium between 7 and 15 percent for each year of college for all college students, including marginal ones. Furthermore, the past three decades have witnessed a remarkable rise in the earnings premium, despite equally remarkable growth in the share of American workers who are college-educated.

The increase in earnings associated with college completion, however, varies considerably. It is largest, for example, for those with postbaccalaureate degrees. Earnings benefits also appear to be associated more with some college majors than with others. Since

the 1980s, technologically driven changes to the structure of the American labor market have caused middle-skilled routine tasks to decline and both higher-skilled nonroutine and lower-skilled manual tasks to increase. Correspondingly, the earnings benefits of college vary across undergraduate majors, as students graduating from programs that foster—or signal—abstract thinking skills realize the largest earnings premiums.

Students uninterested in or unable to complete a four-year college degree nevertheless appear to benefit from completing a two-year degree. Relative to only a high school diploma, there appears to be a positive earnings gain to completing community college. In light of recent technological changes, some students may benefit more from community college programs that foster nonrepetitive manual skills. Programs in this category include those that might result in occupations as emergency medical technicians or automotive repair providers. Though such workers have not seen a substantial rise in earnings, employment opportunities that require the tasks typically performed in these occupations have risen.

Students are also more likely to benefit from postsecondary education the more informed they are about the expenses associated with college and the potential options for financial aid. Financial aid programs can be extremely complex, and students often need help thinking about how to make the college decision. Assistance in getting through the application process and in better understanding options available to them may help students benefit the most from college.

Finally, all of the available evidence, we believe, suggests that before reaching a decision about college, prospective students must give careful consideration to selecting the institution itself, the major to follow, and the eventual occupation to pursue. For any *particular* program at a *particular* school, anticipated future labor market earnings, the likelihood of completion, the costs, and the value of any student debt, must all be factored into the assessment. As difficult as it is, completing such an assessment before reaching a decision is key to making the most out of college.

Endnotes

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3. Christopher Avery and Sarah E. Turner, "Student Loans: Do College Students Borrow Too Much—Or Not Enough?" *Journal of Economic Perspectives* 26, no. 1 (2012): 165–92.

4. John Bound, Michael Lovenheim, and Sarah E. Turner, *Increasing Time to Baccalaureate Degree in the United States*, report prepared for the Population Studies Center (University of Michigan Institute for Social Research, April 2010); and Sarah E. Turner, "Going to College and Finishing College: Explaining Different Educational Outcomes," in *College Choices: The Economics of Where to Go, When to Go, and How to Pay for It*, edited by Caroline M. Hoxby (University of Chicago Press, 2004), pp. 13–61.

5. Returns are uncertain—individuals must form some expectations about the set of likely outcomes under different college options versus not going at all. Those risk-averse will be less interested in college than in cases ignoring uncertainty if the chances of large returns are small.

6. This discussion largely follows Turner, "Going to College and Finishing College" (see note 4).

7. For a discussion of how benefits may differ across individuals, see Pedro Carneiro, James J. Heckman, and Edward J. Vytlacil, "Estimating Marginal Returns to Education," *American Economic Review* 101 (2011): 2754–81.

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11. Erica Field, "Educational Debt Burden and Career Choice: Evidence from a Financial Aid Experiment at NYU Law School," *American Economic Journal: Applied Economics* 1, no. 1 (2009): 1–21.

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13. For an empirical analysis of the option value of college, see Kevin M. Stange, "An Empirical Examination of the Option Value of College Enrollment," *American Economic Journal: Applied Economics*, forthcoming.

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15. Stange, "An Empirical Examination of the Option Value of College Enrollment" (see note 13).

16. Eric P. Bettinger and others, "The Role of Simplification and Information in College Decisions: Results from the H&R Block FAFSA Experiment," Working Paper 15361 (Cambridge, Mass.: National Bureau of Economic Research, September 2009).

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18. Anthony P. Carnevale, Stephen J. Rose, and Ban Cheah, *The College Payoff: Education, Occupations, Lifetime Earnings*, report prepared for the Center on Education and the Workforce (Georgetown University, 2011).

19. Avery and Turner, "Student Loans" (see note 3).

20. Ibid.

21. Carnevale, Rose, and Cheah, *The College Payoff* (see note 18).

22. In each figure appearing in this chapter, annual earnings are approximated by multiplying weekly earnings by fifty-two. To focus on the more recent cohorts, all figures analyze workers aged thirty to fifty, while figures 1 and 2 analyze only the years 2010 and 2011, respectively. Consequently, none of the figures should be interpreted as making statements about the "lifetime" earnings of individuals.

23. Avery and Turner, "Student Loans" (see note 3).

24. David Autor, "The Polarization of Job Opportunities in the U.S. Labor Market: Implications for Employment and Earnings," report prepared for the Hamilton Project and the Center of American Progress (April 2010).

25. Thomas Lemieux and David Card, "Education, Earnings, and the 'Canadian G.I. Bill'," *Canadian Journal of Economics* 34, no. 2 (2001): 313–44.

26. David Card, "Using Geographic Variation in College Proximity to Estimate the Return to Schooling," in *Aspects of Labor Market Behaviour: Essays in Honour of John Vanderkamp*, edited by Louis N. Christofides, E. Kenneth Grant, and Robert Swidinsky (University of Toronto Press, 1995), pp. 201–22.

27. John Bound and Sarah E. Turner, "Going to War and Going to College: Did World War II and the G.I. Bill Increase Educational Attainment for Returning Veterans?" *Journal of Labor Economics* 20, no. 4 (2002): 784–815; Marcus Stanley, "College Education and the Midcentury GI Bills," *Quarterly Journal of Economics* 118, no. 2 (2003): 671–708; and Joshua D. Angrist and Stacey H. Chen, "Schooling and the Vietnam-Era GI Bill: Evidence from the Draft Lottery," *American Economic Journal: Applied Economics* 3 (April 2011): 96–119.

28. Angrist and Chen, "Schooling and the Vietnam-Era GI Bill" (see note 27).

29. Lemieux and Card, "Education, Earnings, and the 'Canadian G.I. Bill'" (see note 25).

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36. Goldin and Katz, "The Race between Education and Technology" (see note 17).

37. Daron Acemoglu and David Autor, "What Does Human Capital Do? A Review of Goldin and Katz's *The Race between Education and Technology*," Working Paper 17820 (Cambridge, Mass.: National Bureau of Economic Research, February 2012).

38. Goldin and Katz, "The Race between Education and Technology" (see note 17).

39. Autor, "The Polarization of Job Opportunities in the U.S. Labor Market" (see note 24).

40. Ibid.

41. Anthony P. Carnevale and Stephen J. Rose, "The Undereducated American," report prepared for the Center on Education and the Workforce (Georgetown University, 2011).

42. Pedro Carneiro and Sokbae Lee, "Trends in Quality-Adjusted Skill Premia in the United States, 1960–2000." Discussion Paper 6107 (Bonn, Germany: Institute for the Study of Labor, October 2010).

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52. John Bound and Sarah E. Turner, "Dropouts and Diplomas: The Divergence in Collegiate Outcomes," in *Handbook of the Economics of Education*, volume 4, edited by Eric A. Hanushek, Stephen Machin, and Ludger Woessmann (Elsevier, 2011), pp. 573–613.

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71. Avery and Turner, "Student Loans" (see note 3).