

NBER WORKING PAPER SERIES

MAKING COLLEGE WORTH IT:
A REVIEW OF RESEARCH ON THE RETURNS TO HIGHER EDUCATION

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Working Paper 19053
<http://www.nber.org/papers/w19053>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2013

A version of this article first appeared in *The Future of Children, Postsecondary Education*, Volume 23, No. 1, Spring 2013, Eds. Cecilia Rouse, Lisa Barrow, and Thomas Brock. Future of Children sponsored this book project. We are grateful to our discussant, Amanda Pallais, the issue editors, and to participants at the Future of Children authors conference for helpful comments and suggestions. Any errors are those of the authors. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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Making College Worth It: A Review of Research on the Returns to Higher Education
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NBER Working Paper No. 19053
May 2013
JEL No. I21,J24

ABSTRACT

Recent stories of soaring student debt levels and under-placed college graduates have caused some to question whether a college education is still a sound investment. In this paper, we review the literature on the returns to higher education in an attempt to determine who benefits from college. Despite the tremendous heterogeneity across potential college students, we conclude that the investment appears to payoff for both the average and marginal student. During the past three decades in particular, the earnings premium associated with a college education has risen substantially. Beyond the pecuniary benefits of higher education, we suggest that there also may exist non-pecuniary benefits. Given these findings, it is perhaps surprising that among recent cohorts college completion rates have stagnated. We discuss potential explanations for this trend and conclude by succinctly interpreting the evidence on how to make the most out of college.

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I. Introduction

Pressure continues on young Americans to attend and complete college. President Obama calls college 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 arguments in favor of college. Recent articles in *The Washington Post* and *Education Week*, for example, show that unemployment rates are much lower for those with a college degree and that college graduates also realize higher lifetime earnings.² Yet, while policy makers and parents continue to push for college, recent trends also reveal that costs are increasing and students are borrowing more than ever before to finance the investment.³ Among those students who do go to college, average study times have fallen and completion rates have stagnated, as those who eventually do acquire a degree take longer to do so than in the past.⁴ Given these facts, how should today's high school students approach college, and how can they make the most out of it if they go? This chapter aims to address these questions by summarizing what we credibly know about the varying costs and benefits of higher education.

In the next section, we explain the 'classic' theory that describes the decision to go to college and the evidence on other factors that likely play a role. Section Three addresses what we know about the return to college and the types of benefits college graduates enjoy. We note that the relative returns to a college education are rising—in terms of lifetime earnings—but are not constant for everyone who decides to attend. They depend, instead, on program of study and the eventual occupation one pursues. We also describe a substantial amount of empirical evidence, almost all of which points to a positive earnings return from the investment in higher education. Section Four describes the leading explanation for the recent rise in college earnings.

Like many others, we suggest that the increase has largely been driven by technological change, which has led to an increase in demand for workers with skills that complement the use of new technologies. In Section Five, we 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 non-pecuniary benefits stemming from college. Returning to the economic benefits of the college premium, Section Seven turns to a discussion of the positive payoffs associated with two-year colleges, while Section Eight covers the returns accruing to 'marginal' students—those students who are on the edge of going and not going. We mention that, despite some concerns about the benefit of college for these students, recent evidence typically shows that their returns are at least as high as the average. Given the positive returns to college, Section Nine tries to explore the rather concerning facts that college completion rates have stagnated and that time to completion has risen. We also 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 chapter concludes by offering some concrete advice for making the most out of the college experience, given the evidence we have to date.

II. How Do Individuals Think About College?

Whether or not someone should go to college is not an easy question to answer since the decision to attend is not the same for everyone. Costs and benefits of college can differ tremendously across individuals and, therefore, it is important to consider the 'worth' of college on a case-by-case basis. The earnings associated with a college degree will be different for each

individual as people differ in the way they are affected by higher education.⁵ Individuals also differ with respect to the costs of college. For example, a student who is relatively impatient may find it particularly unappealing to delay entrance into the labor market in favor of pursuing additional schooling. If we assume that each individual is aware of his or her private benefits and costs, then the standard theory for college attendance has individuals simply weighing the returns of the college investment against the costs. The returns consist primarily of the present value of lifetime earnings associated with a college degree, while the costs consist of both direct costs, such as tuition, and the indirect cost of forgone earnings while in college. If the difference between the benefits and costs is larger than present value of the stream of earnings the individual would realize in the absence of college, we would expect this individual to attend.⁶ If everyone followed this simple investment model, and properly took any uncertainty into account, we could deduce that for those who attend, on average, the present value of the returns to college exceeds the costs and that each individual is therefore making the correct decision.

There are several reasons to believe that individuals do not follow the recipe prescribed by this model. Recent studies have shed light on some factors that are missing from the framework. The most obvious one is the existence of credit constraints. The theory described above assumes that individuals can perfectly borrow against their future incomes and have no aversion holding large amounts of debt. Some recent evidence, however, suggests that over the last two decades an increasing number of potential college students have been pushed against their credit limits.⁷ One study of recent 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.⁸ Individuals who are constrained will either under-invest in

higher education, stopping before it would be optimal to do so, or will not invest at all. Students who do take on college in the presence of credit constraints may also work while in college, thereby reducing the amount of time available for studying. This seems to be a particularly plausible explanation for the increase in student average hours of work from 1993 to 2005. The fraction of high school graduates combining work and school steadily rose from 1970 and peaked in 2005, as college prices continued to rise but sources of financial aid did not follow suit.⁹

Even in the absence of formal credit constraints, individuals may be averse to the idea of holding debt. That is, even though an individual has the option to borrow the amount needed to finance college, he or she may *choose* not to because the thought of being debt burdened is too troubling. Behavior of this type can be thought of as reflecting the existence of an internal borrowing constraint—a constraint self-imposed because an individual is averse to holding debt.¹⁰ Although these constraints do not reflect the existence of borrowing constraints in the credit market, they still have real consequences in the sense that they prevent some people who have a positive college payoff from attending.

Recent evidence has shown that the prospect of having to carry debt indeed has behavior altering consequences. In an effort to examine the affect of debt on career choices, a 2009 study analyzed an experiment conducted by New York University's School of Law.¹¹ The University offered students two distinct financial aid options: the first option consisted of tuition loans that the student could take out when entering law school, which the University would repay if, upon graduation, that student accepted employment in the low-paying public sector; the second option consisted of tuition waivers that were issued by the University, which the student would have to repay upon graduation if they did not accept employment in the low-paying public sector. The

key feature of the experimental design was that the two aid packages were equivalent in monetary value, but differed in the horizon over which a student was considered to be in debt. The results showed that those who had their tuition waived had a significantly higher rate of first job placement in the public sector, and had an increased likelihood of actually enrolling into the law school.

Several other deviations from the simple investment theory of college attainment give reason to believe that some individuals are missing out on welfare-improving opportunities. One example is incomplete information. If students are not completely informed about costs and benefits of higher education, they may not correctly invest. Most studies that examine this issue conclude that potential students are aware of the benefits of a postsecondary education, but tend to persistently overestimate costs and are uninformed about sources of financial aid.¹² In addition to being misinformed about costs, potential students may lack information about their own ability to succeed in college.¹³ Students may be over (or under)-confident about their ability to perform well in college. In this respect, there is an option value to college as students use college to learn about their individual abilities, about the costs of college, and about labor market conditions and future earnings prospects.¹⁴ While in college, students 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.

Even with perfect information, the complexity of popular financial aid programs may prevent their use. A recent experimental study explored the significance of the complexity of financial aid programs as obstacles to college attendance.¹⁵ The study divided low-income families who visited a tax preparation center into three groups. The full treatment group was

assisted with completing a Free Application for Federal Student Aid (FAFSA) form and given information about their financial aid eligibility and tuition prices for nearby colleges. The information only group was given information on their eligibility and college tuition, but was only encouraged to complete the FAFSA. Finally, the control group was only given a brochure with basic information about college and financial aid. The experiment revealed that high school seniors whose parents received FAFSA assistance were substantially more likely to go to, and stay in, college than those who did not (a 25% increase in enrolment and retention).

The finding that such a small intervention makes the difference between going and not going to college suggests that not all individuals follow the straight-forward investment model when making attainment decisions. Even in the absence of complexity, students appear to be sensitive to how financial aid offers are framed. One study discovered that students tended to be more responsive to aid packages that included the word 'scholarship' instead of the word 'grant,' even though both packages were of equal size.¹⁶

This discussion illustrates three important issues about the college decision: (1) it would be inappropriate to treat all individuals similarly when thinking about optimal attainment decisions: individuals differ in terms of what they are likely to get out of higher education; (2) individuals may face financial constraints that prohibit them from taking advantage of more education; and (3) even in the absence of debt concerns, information problems and behavioral idiosyncrasies can cause individuals to behave in a manner that makes them worse off. The evidence suggests we cannot always presume that each individual is doing what is best for them, whether they go or not. This leaves open possibilities for policies aimed at relaxing constraints, providing information, narrowing program choice, or simplifying the application process to improve well-being.

III. College Premia, Returns, and Measurement Issues

A. Descriptive Differences

It is well documented that those with college education earn more relative to those with a high school degree, and that the difference has been persistently growing over the past few decades.¹⁷ Over a career, a study from the Georgetown University Center on Education and the Workforce calculated that in 1999 the average lifetime earnings of a bachelor's degree holder was 75 percent more than the earnings of a high school graduate, and that by 2009 the premium grew to 84 percent.¹⁸ Another study estimated lifetime earnings for an average individual who graduated from college in 2009 to be worth about \$1.2 million net of tuition expenses compared to \$780,000 for an average individual who graduated from high school.¹⁹ Aside from just the monetary gain associated with a college degree, college graduates tend to have a larger probability of being employed. In November of 2011 the unemployment rate for college graduates was 4.4 percent, compared to 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 They tend to be 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, was a little over \$3 million, compared with about \$1.2 million for a peer in the health support sector. Although they earned much less than in the STEM sector, college educated workers in health support still earned more than those with only high school.

Figure 1 shows these patterns by displaying average earnings in 2010 for full-time workers, aged thirty to fifty, from the Current Population Survey.²² As noted, the largest average earnings for college graduates are experienced by those in the managerial, STEM, and health professional sectors. The earnings of those with post-bachelor degrees are also highest in these fields. Furthermore, the figure reveals that earnings for bachelor's degree holders are lowest in the health support, education, and personal service sectors. Therefore, it is clear that both education *and* choice of occupation are important determinants of labor market outcomes. 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

To provide a different perspective on the evidence, Figure 2 presents the 10th, 25th, 50th, 75th, and 90th percentiles of the earnings distributions in 2011 for three different education levels (high school degree, college degree, and graduate degree) among full-time workers, aged thirty to fifty. Several items about this figure are worth noting. First, the median annual earnings for high school graduates is about \$34,000, compared to \$57,000 for bachelor's degree holders. That is, at the middle of the earnings distributions in 2011 those with a bachelor's degree earned about 67 percent more than those with only a high school education. The earnings differences increase when comparing individuals in the same percentile further up the distribution 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. When separating out the overall premium by type of degree, it is apparent that while the premium to a bachelor's degree is high, the premium to a graduate degree is even

higher. Some studies suggest that a significant part of the rise in the college premium can be attributed to the increased earnings among those with post-bachelor degrees.²⁴

In short, a college education is associated with higher labor market earnings across all major occupation sectors. Caution must, of course, be taken when interpreting the evidence as a causal effect of college on earnings. The evidence presented in this section thus far should not lead one to conclude that if any high school graduate went to college, he or she should expect to realize these labor market benefits. Individuals differ widely with respect to costs and benefits of college. 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 This leads to the well-recognized problem of self-selection: since individuals *choose* whether or not to attend college, if those with the highest propensity to succeed are the ones who usually choose to attend, we cannot claim that college explains their outcomes, nor can we claim that encouraging more youth to attend college will generate similar outcomes.

B. Causal Estimates of Returns to College

To circumvent issues of selection, a common approach has been to exploit natural experiments—for example, circumstances or policy changes beyond individuals' control—that cause one group to obtain more college relative to another group. One such natural experiment compares individuals who live within commuting distance to a college with others who do not. Those who grow up near a college face lower costs of higher education and are more likely to attend than individuals who have similar characteristics but live farther away. The conditions of

this natural experiment enable researchers to estimate how much college proximity affects college going 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 using the GI Bill and the Vietnam War.²⁸ This study exploited the fact that starting in December of 1969, draft lotteries were held to determine conscription. In each annual draft lottery, random sequence numbers (RSN) were assigned to all dates of birth for men in the relevant cohorts. Each lottery had an associated draft-eligibility cut-off, where men with a RSN below the cut-off were draft-eligible and those with RSNs above the cut-off were not. As one would expect, being draft-eligible was highly correlated with Vietnam veteran status, but since 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, the researchers were able to isolate variation in schooling that is driven by random draft-eligibility and not unobserved individual factors. The study showed that randomly drafted veterans indeed acquired 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 Veteran's

Rehabilitation Act (VRA), and found that an extra year in higher education improved earnings for veterans by about 15 percent.²⁹

A problem with these estimates is that they apply only to older cohorts affected by college proximity or draft lotteries several decades ago. As such, they are quite outdated, as the fraction and types of individuals enrolling in college has since dramatically changed. It may, therefore, not be prudent to extrapolate these returns and conclude they apply to different types of individuals or more recent cohorts.

A study looking at more recent cohorts uses a matching approach to estimate college returns for individuals with different predicted probabilities of completing. 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 to 10 percent predicted probability of completing college, completion raised earnings about 30 percent; for those with a 60 to 100 percent predicted probability, it raised earnings only about 10 percent. A concern with this study's approach, however, is that it relies on the assumption that, for those with similar probabilities of completing college, reasons for actual attendance do not account for the earnings differences observed.

Unfortunately, there exists room for skepticism with all of the estimated returns mentioned above. More research is needed to generate consensus on what college does to more recent cohorts and different types of students. A more convincing analysis on the recent returns to college, in particular for students at the margin of going, comes from a study comparing high school seniors from Florida who barely qualified to attend one of the state's public colleges to those who barely missed the academic cut-off.³¹ Using data from the Florida State University System (FSUS) on six cohorts of 12th grade students representing the high school graduating classes from 1996 to 2002 (the 1997 cohort was omitted), 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 intuition is that barely falling above or below the cut-off is essentially randomly determined, and that as a result, students on either side of the cut-off are not systematically different.

The study looked at students who barely crossed the threshold at a particular university, Florida International University. Since this school had lower admissions standards than any other postsecondary institution in the system, students who barely fell short of the cut-off typically did not attend any FSUS school. The results are therefore interpreted as the gain marginal students experience by attending a four-year institution relative to those who do not attend, but possibly do attend a community college. The results suggest that the return to these marginal students of a year at a four-year college was about 11 percent, and that each marginal admission yields earnings gains of 22 percent eight to fourteen years after high school graduation.³²

IV. An Increase in the Demand for College-Related Skills?

Arguably the most important piece of evidence on the generally positive benefits from college comes not from exploiting natural experiments, but from noting the remarkable rise in the earnings premium associated with a college degree, despite an equally impressive rise in the number of students obtaining a college degree. Many economists have conjectured that the integration of computers and information technology over the last few decades has led to a general reorganization of the way that firms produce and a corresponding change in worker demand towards those with more abstract, multi-level, and non-cognitive skills. Think of this, for example, as a race between education attainment, a proxy measure for the supply of skilled workers, and skill-biased technology used by firms, representing the demand for skilled workers.³³ Changes in technology are said to be skill-biased when they demand, or are more complementary to, highly skilled workers.³⁴ Around 1980, the growth in demand for college-related skills started to outpace supply and has been winning the race ever since. For the past three decades, technological change has led to increased growth in the demand for skilled workers, and because the supply of college educated workers has not increased at the same rate, employers have bid up the wages of college graduates causing the rise in the college earnings premium.

Figure 3 provides graphical evidence of this phenomenon for full-time workers who are thirty to fifty years old. The figure shows the evolution of the wage premium for college graduates, along with the evolution of the relative supply of college educated workers and those with only high school. Relative supply is calculated as the proportion of workers who have a college degree or more, divided the proportion who have only high school, minus one. It reveals how many more college educated workers (in percentage terms) there are than workers with only a high school diploma. Figure 3 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. What's more, the relative supply of college educated workers has also been steadily increasing throughout the same time period. In 2010 there were about 36 percent more college educated workers than those with only high school. The fact that the relative supply *and* the wage premium have grown over the period suggests that the growth in relative demand for college educated workers must have outpaced the growth in supply.

Throughout the past three decades there has also been a growing polarization of both employment and earnings. Employment opportunities and earnings have been increasing in high-education professional, technical, and managerial occupations, as well as in low-education food service, personal care, and protective service occupations. However, throughout the same period, employment and earnings have been falling in middle-skill, clerical, administrative, and sales occupations, as well as in middle-skill production, craft, and operative occupations.³⁵ Leading explanations for these polarization patterns are the computer automation and off-shoring of middle-skilled, routine tasks. These are often the tasks that were previously performed primarily by workers with a high school diploma, but less than a four-year college degree, and were present in activities such as bookkeeping, clerical work, and repetitive production.³⁶

Understanding how technological advancement increases the college premium may help improve our understanding of the college production function. If technological change increases relative earnings for college graduates, it does so through an increase in relative demand for the skills of college graduates. Under this theory, college students have superior non-routine, abstract skills that require problem solving, multi-tasking, and creativity. Individuals with no more than high school attainment, however, may still benefit from an increase in demand for manual skills that cannot be automated. However, since 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, despite the increase in relative demand, wage growth has not been as rapid for less-educated workers. This point is emphasized by Figure 3, as it shows the persistent rise in the earnings premium of college workers over both high school graduates and those with only some college.

Some have questioned the conclusion of an undersupply of college graduates today and countered that many workers with a bachelor's degree are ending up in jobs that do not require these credentials. A study entitled, "The Undereducated American," conducted by Anthony P. Carnevale and Stephen J. Rose for the Georgetown University Center on Education and the Workforce further explored this claim.³⁷ The results indicated that *within* occupations, those with a bachelor's degree almost always earn significantly more, on average, than those with only a high school diploma. This was true even in the low-skilled occupation tier comprised of labor, sales, operative, or service workers. If employers are acting rationally, then they must be paying for some added benefits that are associated with hiring college educated workers. As we saw above, these added benefits likely represent the higher analytic and technical skills that college degree holders possess.

Another counter to the argument that changes in technology favor the college educated is that a decline in average ability among leftover high school graduates would also produce a rise in the college premium, without college itself affecting earnings. As noted, the last few decades have witnessed an increase in college attainment rates, which affects the composition of both college and high school graduates, probably by decreasing average measures of innate ability for both groups. A significant enough drop in average high school graduate productivity levels could then account for the rise in relative earnings of college graduates. A 2010 study attempts to

measure the rise in demand for college-related skills after controlling for shifts in initial high school and college student ability from 1960 to 2000.³⁸ The study compared individuals working in the same region, but who were born in regions with differing levels of college enrolments, 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. The study concluded that, the evolution of the college wage premium from 1960 to 2000 would actually have been 6 percentage points *higher* had college quality remained constant.³⁹ 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.

V. Signaling

An ongoing debate exists over the extent to which college itself improves skill or simply signals the presence of skill. The debate has intensified recently with the release of *Academically Adrift*, a book that presents extensive research pointing toward the fact that a large portion of undergraduate students do not actually demonstrate an improvement in skills while in college.⁴⁰ With falling study time, and pressure on faculty to pass most students, some wonder whether college actually develops new skills or produces a signal of skill already acquired before the college experience. While evidence generally exists that both stories play a role in generating higher earnings, it has proven frustratingly difficult to determine which theory matters more, and when.

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 or 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.⁴¹ 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.

The study found that AFQT 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 AFQT, 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, suggests that college educated workers are not simply separating themselves from those who have only a high school degree. 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.⁴²

The fact that employers seem to eventually 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 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. Section Three showed that students who graduated from computer science, engineering, and math programs had 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 these graduates, the link between the occupational tasks they perform and the skills they develop in college is perhaps less evident. It is more plausible that they already possessed the productivity employers value prior to college, and simply used college to signal these skills to the labor market. However, as there is no general consensus on how much students actually learn in different college programs, the exact role of signaling still remains to be determined.

VI. Non-pecuniary Benefits from college?

The evidence presented above generally suggests that there are significant pecuniary returns to college. It is worth mentioning the possibility of non-pecuniary benefits as well, both while in college and after graduation. 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 non-pecuniary 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 non-college graduates.⁴³ Several studies have also shown that college graduates tend to enjoy better health outcomes on average.⁴⁴

The non-pecuniary 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 non-pecuniary

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.⁴⁵

A 2011 study used two strategies to capture the causal effects of schooling on non-pecuniary outcomes.⁴⁶ 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 non-pecuniary 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.

VII. Returns to Two Year Colleges

Some research has specifically attempted to look at returns to two-year community colleges. A 1995 study using a sample of individuals who were fourteen to twenty-one years

old in 1979 found that the average person realized about a 4 to 7 percent return to a year of community college, compared to a return of about 6 to 9 percent for a year completed at a four-year college.⁴⁷ To provide a causal interpretation for their estimate, the researchers controlled for several variables that may be related an individual's family background and ability. While we may worry that remaining selection bias cannot be ruled out, similar results were obtained in an earlier version of the study, which used the method described above of comparing individuals by distance to college in an effort to eliminate any unobserved personal characteristics that may confound the results.⁴⁸

A more recent study used detailed administrative data from Kentucky that tracked two cohorts of students that entered the state's community college system during the 2002-2003 and the 2003-2004 school years.⁴⁹ The researchers used changes in individuals' own education attainment to estimate that, on average, high school educated women gained nearly 40 percent higher earnings after obtaining associates degrees or diplomas, while men gained approximately 18 to 20 percent higher earnings. The returns to certificates were found to be around 9 percent for men and 3 percent for women. To alleviate additional concerns that unobserved reasons behind choosing to go back to school drive the results, the researchers controlled for variables designed to capture students' labor market intentions.

Another 2011 study adopting a similar before-after comparison analyzed returns to two-year colleges for individuals between the ages of twenty-four and thirty in 2008.⁵⁰ To further identify any additional boost to completing a private two-year college, a comparison was made between the before and after gains of private sector students to the before and after gains of public sector students. The results suggested that students who complete an associate's degree at a public or private college experienced an earnings return of about 15 to 17 percent, or 8 percent

per year of education. However, the study did not find any additional benefit to completing a private community college, which may be a little concerning given the higher costs of private for-profit education.

VIII. Marginal Students

Individuals at the margin of going to college are particularly interesting from a policy perspective. If we believe that individuals make decisions about college attendance based on the cost-benefit analysis described above, then it follows that those who are most likely to go to college are the ones who are most likely to benefit from college. This idea is formalized in a 2011 study, which explains why we might want to be careful when considering college enrolment expansion policies.⁵¹ In particular, unless the policy change in question is the same one we are using to estimate college returns, the individuals pushed into college by the policy may experience very different returns than those documented above. The paper demonstrates this by considering three different hypothetical policy changes and shows that for each policy change, the specific policy-relevant treatment effect of college is lower than the return to college estimated by using the common techniques previously described. The intuition can be framed as follows: If we believe that the college decision is made based on a cost-benefit analysis, then those students who choose to go are the ones with the largest returns, while those who opt not to go have the lowest returns. It is *because* they have the least to gain that the marginal students are least likely to attend. Since the policies induced these students to attend, it is natural that we see them realizing lower returns.⁵²

While this study raises important concerns that should be kept in mind, the majority of the empirical literature suggests that the returns to marginal students are at least as high as the

average, if not higher.⁵³ The previous argument relies on the idea that the probability of college attendance is determined primarily by economic factors. We may also believe, however, that college attendance is determined by cultural or social circumstances. This adds a dimension of complexity to the college decision, and if we adopt this view, then it may very well be that factors other than the potential economic gains of college are causing a low probability of attendance for some students. If individuals with low levels of social or cultural capital face especially poor labor market outcomes in the absence of college, then, as a result of this different college selection mechanism, students who are least likely to go to college may actually have the highest potential returns.⁵⁴ Developing policies to target marginal students may then lead to large private and social gains.

IX. The Importance of Completion and School Quality

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.⁵⁵ Put differently, over and above the number of years one attends college, possessing a college degree provides an additional boost to one's earnings. Graphical evidence consistent with diploma effects can be seen in Figure 4. The figure displays annual earnings at select percentiles of the earnings distributions and compares bachelor's degree holders to those with only high school and those who completed some college but failed to obtain a degree. We see that workers with a bachelor's degree earn more at every percentile than those who completed some college but did not graduate. What's more, at every percentile, the earnings of workers who only complete some college are only marginally higher than the earnings of high school graduates, suggesting that there may be significant benefits to completion. Evidently, relative to

a high school diploma, only completing some college and then dropping out is not associated with the same earnings boost as a bachelor's degree.

Deciding to pursue a degree and failing to obtain one is also associated with real costs. Not only do these students incur the financial loss associated with enrolling in college, but they also pass up the opportunity to enter the job market sooner, gain experience, and potentially find better jobs.⁵⁶ Likewise, longer completion times are also associated with additional tuition fees and missed labor market experience. Given that there are real costs associated with not completing college or prolonging time to completion and large benefits to obtaining a college degree, it appears to be quite counter-intuitive that, among recent cohorts, completion rates have stagnated and time to completion is rising. Several hypothesis have been put forth to explain this paradox and we discuss a few in this section.

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.⁵⁷ 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.⁵⁸ 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 enrolment. 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.⁵⁹ 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—actually outweighs the costs associated with failing to complete.

To put the recent college completion trends into perspective, between 1970 and 1999 the college enrolment rates of students aged twenty-three who were pursuing a bachelor's degree rose substantially but completion rates fell by 25 percent.⁶⁰ 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.⁶¹

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 using 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.⁶² 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.⁶³ Increased enrolment that is not accompanied by additional resources leads to increased time to completion

through crowding and course enrolment 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 timeframe. 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 enrolment size.⁶⁴

Research has also 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.⁶⁵ When the study analyzed the earnings differences between students who attended more selective institutions and those who were accepted by the same 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.⁶⁶ A 2009 study by Mark Hoekstra, for example, found that attending a flagship state university had large positive earnings effects for twenty-eight- to thirty-three-year-old individuals.⁶⁷ It compared the earnings of students who attended the school after falling just above the academic admissions cut-off to the earnings of students who were just below the cut-off and did not attend. Because picking students who fall just below or just above the cut-off 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 enrolment rates have risen over the past few decades, but completion has not followed suit, policymakers have thus begun to place more emphasis on college completion.

X. Costs and Student Debt

A. College Costs

Having reflected at length about the benefits associated with college completion, we now consider how cost and student debt figure in the college investment. Recent statistics provided by the College Board indicate that average annual tuition and fees for four-year colleges are approximately \$8,200 for in-state students and \$20,770 for out-of-state students.⁶⁸ 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.⁶⁹ Costs at private four-year institutions average around \$28,500. At private non-profit 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 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.⁷⁰ 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.⁷¹ 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.⁷² 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.⁷³ 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 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 \$21,000 in excess of annual high school earnings. Such an investment in college would clearly be a sound one. In fact, since 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.

B. Debt Levels

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.⁷⁴ 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 enrolment 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 enrolment, 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, under-invest 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.

XI. Conclusion

The evidence presented above suggests that there are, in general, significant returns to a college degree. While these benefits are not constant across all college programs and occupations, college graduates do enjoy an earnings premium across all major occupation sectors. The empirical evidence also suggests that those at the margin of attending (whether due to financial constraints or otherwise) benefit at least as much as those from the more general college population. Students with high risk of failing out, however, may be wise to not to attend as the evidence suggests that those who only obtain some college do not realize significantly higher average earnings over workers with only high school. Although the option value of college should be given fair consideration, if an individual expects to be unable to obtain a degree, the investment might not generate enough of a return to justify tuition and other expenses. The facts that academically marginal students seem to realize earnings returns that are at least as high as the average, while college dropouts do not benefit nearly as much may appear to contradict one and other. However, in the Florida study discussed above, the graduation rate of marginal students who barely received college admission was similar to that in the broader student population. This accords with the evidence discussed in Section Nine, which suggests

that changes in academic preparedness cannot explain much of the recent decline in college completion rates.

Throughout the past three decades, the college earnings premium has increased rapidly. Many researchers believe skill-biased technological change has caused a large growth in demand for workers with abstract and cognitive reasoning skills, and skills that cannot easily be automated. Despite the large returns from completion, overall college completion rates have stagnated and students who are finishing are taking longer to do so than in the past. The most recent evidence suggests that this is likely due to financially constrained low-income students, and falling resources per-student at non-selective institutions. If we are to reduce earnings inequality in America, policies designed for producing more college graduates must receive serious consideration.

So how does a high school graduate make the most out of college? Since the 1980s we have seen technologically driven changes to the structure of the American labor market. Middle-skilled routine tasks are fading, while non-routine, abstract and manual task employment opportunities are growing. 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. Therefore, prior to applying to college, one should carefully consider both the college program and the eventual occupational sector he or she intends to pursue. Given that there appears large benefits to completion, students would also be wise to research past completion rates at their schools of interest in order to minimize the likelihood of dropping out. While evaluating program and school choices, graduate school is worth considering as a future option: as we saw, the largest increase in earnings associated with college completion is for those with post-bachelor degrees.

Potential students who are not convinced that a four-year program is right for them may want to consider a two-year institution. We saw that, relative to only a high school diploma, there is a positive earnings gain to completing community college. In light of recent technological changes, community college programs that foster non-repetitive manual skills would be worth considering.

Finally, evidence suggests that potential students often overestimate the costs associated with a college education. We have also seen that financial aid programs can be extremely complex and that students sometimes give too much weight to details that should be irrelevant in the college decision. Therefore, it is important to be as well informed as possible about the expenses associated with college and the potential options for financial aid. This may require a little more research, but the payoff can be substantial. High school counselors and administrators also have a role in offering assistance in getting through the application process and helping students better understand options available to them. High school graduates should also reflect on their personal likelihood of success in the college program they would like to pursue and foster the motivation to complete. The more informed and aware a student becomes about the expected costs and benefits, the better opportunity he or she will have to make the most out of college.

¹ "Obama Renews Push For Higher Education, Hints at Santorum 'Snob' Comment," *ABC News*, February 27 2012 (<http://abcnews.go.com/blogs/politics/2012/02/obama-renews-push-for-higher-education-hints-at-santorum-snob-comment/>); and President Barack Obama, Address to Joint Session of Congress, February 24, 2009.

² "Education and unemployment." *The Washington Post*, February 27, 2012

(http://www.washingtonpost.com/politics/education-and-unemployment/2012/02/27/gIQARNmzeR_graphic.html); and "New Study Tracks Lifetime

Income Based on College Major." *Education Week*, March 24 2011

(http://blogs.edweek.org/edweek/college_bound/2011/05/new_study_tracks_lifetime_income_based_on_college_major.html?qs=lifetime+college+earning).

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): 165-192.

⁴ John Bound, Michael Lovenheim and Sarah E. Turner (2010), *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); 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; and Philip Babcock and Mindy Marks, *Leisure College, USA: The Decline in Student Study Time*, report prepared for the American Enterprise Institute for Public Policy Research (August 2010).

⁵ For a discussion of how benefits may differ across individuals, see: Pedro Carneiro, James J. Heckman, and Edward J. Vytlačil, "Estimating Marginal Returns to Education," *American Economic Review* 101 (2011): 2754–81.

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

⁷ Lance Lochner and Alexander Monge-Narnjo, "Credit Constraints in Education," *Annual Review of Economics*, forthcoming.

8. Philippe Belley and Lance Lochner, "The Changing Role of Family Income and Ability in Determining Educational Achievement." *Journal of Human Capital* 1, no.1 (2007): 37–89.

⁹ Judith Scott-Clayton, "What Explains Trends In Labor Supply Among U.S. Undergraduates, 1970-2009?" Working Paper 17744 (Cambridge, Mass.: National Bureau of Economic Research, January 2012).

¹⁰ Ibid.

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.

¹² For a more complete discussion of information constraints see: Judith Scott-Clayton, "Information Constraints and Financial Aid Policy," Working Paper 17811 (Cambridge, Mass.: National Bureau of Economic Research, February 2012).

¹³ James J. Heckman, Lance J. Lochner, and Petra E. Todd, "Earnings Functions, Rates of Return and Treatment Effects: The Mincer Equation and Beyond," in *Handbook of the Economics of Education*, vol. 1, edited by Eric A. Hanushek and Finis Welch (Elsevier, 2006), pp. 307–458.

¹⁴ 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.

¹⁵ Eric P. Bettinger, Bridget T. Long, Philip Oreopoulos and Lisa Sanbonmatsu, "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).

¹⁶ Christopher Avery and Caroline M. Hoxby, "Do and should Financial Aid Packages Affect Students' College Choices?" 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): 239-302.

¹⁷ For a description of the trend in the college premium throughout the 20th century and into the 21st see: Claudia Goldin and Lawrence F. Katz, "The Race between Education and Technology: The Evolution of U.S. Educational Wage Differentials, 1890 to 2005." Working Paper 12984 (Cambridge, Mass.: National Bureau of Economic Research, March 2007).

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 and Rose, "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. In order to focus on the more recent cohorts, all figures analyze workers aged thirty to fifty, while Figures 1, 2 and 4 analyze only the years 2010 or 2011. 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 prepared 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): 313-344.

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, (Toronto: University of Toronto Press, 1995), pp. 201-222.

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 Joshua D. Angrist and Stacey H. Chen, "Schooling and the Vietnam-Era GI Bill: Evidence from the Draft Lottery" (See note 27).

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

³⁰ Jennie E. Brand and Yue Xie, "Who Benefits Most from College? Evidence for Negative Selection in Heterogeneous Economic Returns to Higher Education." *American Sociological Review* 75, no. 2 (2010): 273-302. .

³¹ Seth Zimmerman, "The Returns to College Admission for Academically Marginal Students," *Journal of Labor Economics*, forthcoming.

32. Since some students just below the threshold attended a community college, the estimate of 11 percent can be understood as a lower bound on the return to college over obtaining only a high school diploma.

³³ Goldin and Katz, "The Race between Education and Technology: The Evolution of U.S. Educational Wage Differentials, 1890 to 2005" (See note 17).

³⁴ 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).

³⁵ Autor, "The Polarization of Job Opportunities in the U.S. Labor Market: Implications for Employment and Earnings." (See note 24).

³⁶ Ibid.

³⁷ Anthony P. Carnevale and Stephen J. Rose, *The Undereducated American*, report prepared for the Center on Education and the Workforce (Georgetown University, 2011).

³⁸ Pedro Carneiro and Sokbae Lee, "Trends in Quality-Adjusted Skill Premia in the United States, 1960-2000." Discussion Paper 6107 (Bonn, Germany: The Institute for the Study of Labor (IZA), October 2010).

³⁹ While higher college enrolment led to a decline in the average quality of college graduates, the authors are unable to distinguish between two competing interpretations of their finding. On one hand, an enrolment expansion draws in less prepared students, which results in a decline in average student quality. On the other, increased enrolment that is not accompanied by an increase in institutional resources will likely result in a lower-quality learning experience in college.

⁴⁰ Richard Arum and Jospia Roksa, *Academically Adrift: Limited Learning on College Campuses* (The University of Chicago Press, 2011).

⁴¹ Peter Arcidiacono, Patrick Bayer, and Aurel Hizmo, "Beyond Signaling and Human Capital: Education and the Revelation of Ability," *American Economic Journal: Applied Economics* 2 (October 2010): 76–104.

⁴² For a recent analysis on earnings differences by institutional quality see: Mark Hoekstra, "The Effect of Attending the Flagship State University on Earnings: A Discontinuity-Base Approach." *Review of Economics and Statistics* 91 no.4 (2009): 717–24.

⁴³ Philip Oreopoulos and Kjell G. Salvanes, "Priceless: The Non-pecuniary Benefits of Schooling." *Journal of Economic Perspectives* 25, no.1 (Winter 2011): 159–84.

⁴⁴ Michael Hout, "Social and Economic Returns to College in the United States." *Annual Review of Sociology* 38 (2011): 379-400.

⁴⁵ Oreopoulos and Salvanes, "Priceless: The Non-pecuniary Benefits of Schooling." (See note 43).

⁴⁶ Ibid.

⁴⁷ Thomas J. Kane and Cecilia Elena Rouse, "Labor-Market Returns to Two- and Four-Year College." *The American Economic Review* 85, no.3 (1995): 600-614.

⁴⁸ Thomas J. Kane and Cecilia Elena Rouse, "Labor-Market Returns to Two- and Four-Year Colleges: Is A Credit A Credit And Do Degrees Matter?" Working Paper 4286 (Cambridge, Mass.: National Bureau of Economic Research, January 1993).

⁴⁹ Christopher Jepsen, Kenneth Troske, and Paul Coomes, "The labor-market returns to community college degrees, diplomas, and certificates," report prepared for the Center for Poverty Research (University of Kentucky, October 2009).

⁵⁰ Stephanie Riegg Cellini and Latika Chaudhary, " The Labor Market Returns to a Private Two-Year College Education." George Washington University Working Paper (April 2011).

⁵¹ Carneiro, Heckman and Vytlačil, "Estimating Marginal Returns to Education." (See note 5).

⁵² While this study raises important concerns, the evidence that is presented may be outdated.

The data employed by the study track the cohort of students that were 14-22 years old in 1979.

Since then, college student composition has changed, and as a result, one may wonder if the same results would prevail with more recent data.

⁵³ Hout, "Social and Economic Returns to College in the United States" (See note 44).

⁵⁴ For a discussion of the two perspectives on the factors that determine the probability of attending college see: Brand and Xie, "Who Benefits Most from College?" (See note 30).

⁵⁵ Fabian Lange and Robert Topel, "The Social Value of Education and Human Capital" in *Handbook of the Economics of Education* Volume 1, edited by Eric A. Hanushek and Finis Welch (Elsevier, 2006), pp. 459-509.

⁵⁶ Carnevale and Rose, "The Undereducated American" (See note 37).

⁵⁷ 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.

⁵⁸ This discussion follows: Lange and Topel, "The Social Value of Education and Human Capital" (See note 55).

⁵⁹ Todd R. Stinebrickner and Ralph Stinebrickner, "Learning About Academic Ability and the College Drop-out Decision," Working Paper 14810 (Cambridge, Mass.: National Bureau of Economic Research, March 2009).

⁶⁰ This discussion largely follows Turner, "Going to College and Finishing College" (See note 4).

⁶¹ For a more elaborate discussion on student employment and its consequences see: Bound and Turner, "Dropouts and Diplomas: The Divergence in Collegiate Outcomes" (See note 57); and

Scott-Clayton "What Explains Trends in Labor Supply Among U.S. Undergraduates, 1970 – 2009?" (See note 9).

⁶² Bound, Lovenheim and Turner, "Increasing Time to Baccalaureate Degree in the United States" (See note 4).

⁶³ John Bound and Sarah E. Turner, "Cohort Crowding: How Resources Affect Collegiate Attainment." *Journal of Public Economics* 91 no.5-6 (2007): 877-899.

⁶⁴ Bound, Lovenheim, and Turner, "Understanding the Decrease in College Completion Rates and the Increased Time to the Baccalaureate Degree" a report prepared for the Population Studies Center (University of Michigan Institute for Social Research (November 2007).

⁶⁵ Stacey Berg Dale and Alan B. Krueger, "Estimating the Payoff To Attending A More Selective College: An Application of Selection on Observables and Unobservables" *The Quarterly Journal of Economics* November 2002: 1491 - 1527.

⁶⁶ Bound and Turner, "Dropouts and Diplomas: The Divergence in Collegiate Outcomes" (See note 57).

⁶⁷ Hoekstra, "The Effect of Attending the Flagship State University on Earnings" (See note 42). Due to data confidentiality reasons, the study only refers to the institution in question as the "state flagship university."

⁶⁸ College Board, Advocacy and Policy Center, 2011, "Trends in College Pricing" http://trends.collegeboard.org/downloads/College_Pricing_2011.pdf

⁶⁹ College Board, Advocacy and Policy Center, 2011, "Trends in College Pricing," figure 2.

⁷⁰ Scott-Clayton, "Information Constraints and Financial Aid Policy" (See note 12).

⁷¹ Sandy Baum and Saul Schwartz, "Is College Affordable? In Search of a Meaningful Definition" (Institute for Higher Education Policy, 2012)

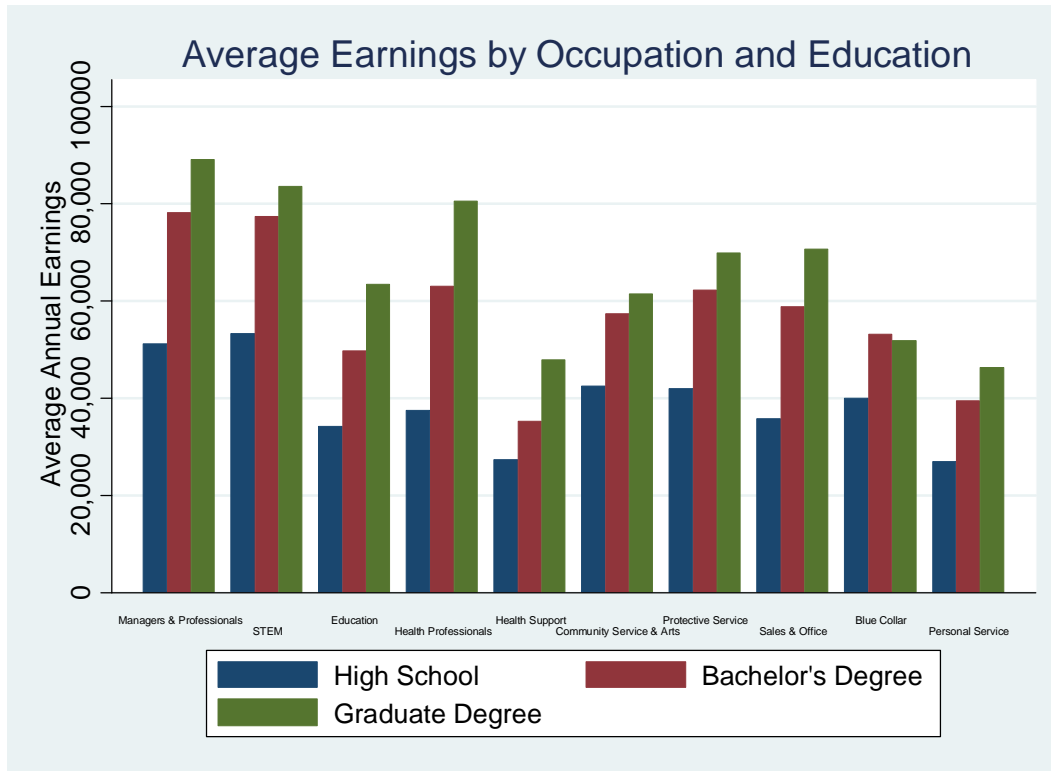
⁷² College Board, Advocacy and Policy Center, 2011, "Trends in College Pricing," figure 7.

⁷³ Carnevale and Rose, "The Undereducated American" (See note 37).

⁷⁴ Avery and Turner, "Student Loans" (See note 3).

Making College Worth It Figures

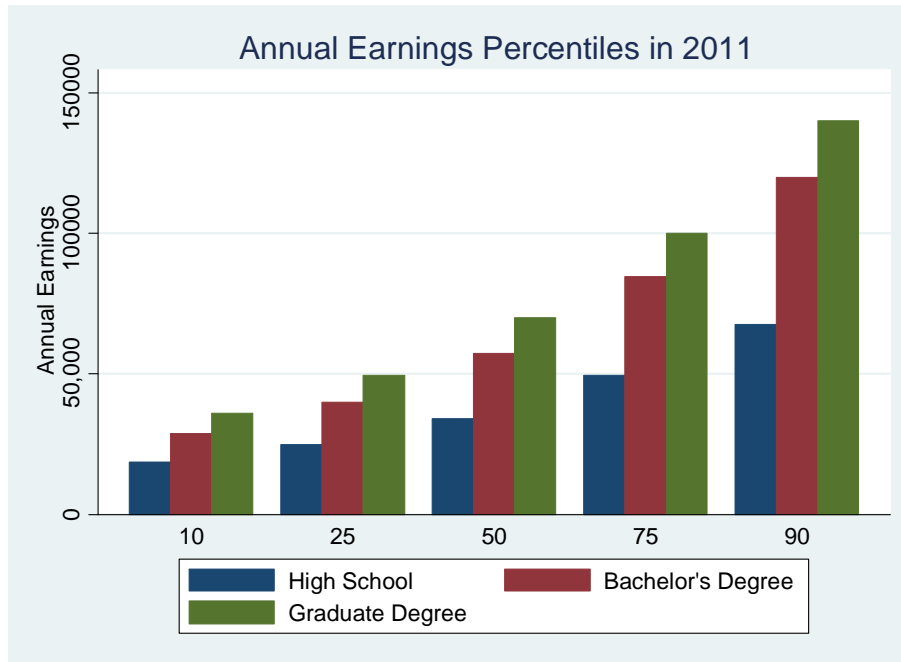
Figure 1



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

Notes: The sample is restricted to full-time workers between ages 30-50. Graduate Degree consists of workers with Master's and Doctorate degrees.

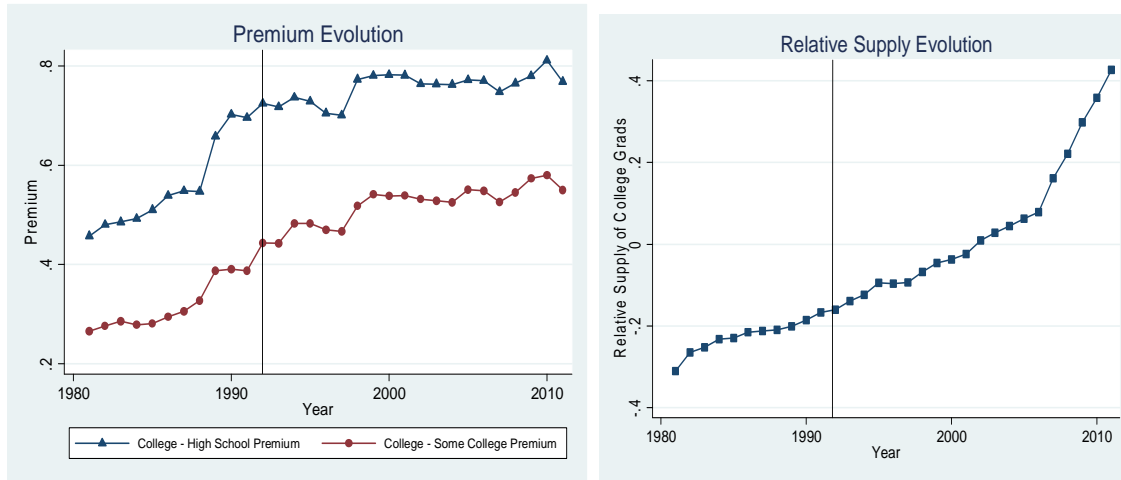
Figure 2



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

Notes: The sample is restricted to full-time workers between ages 30-50.

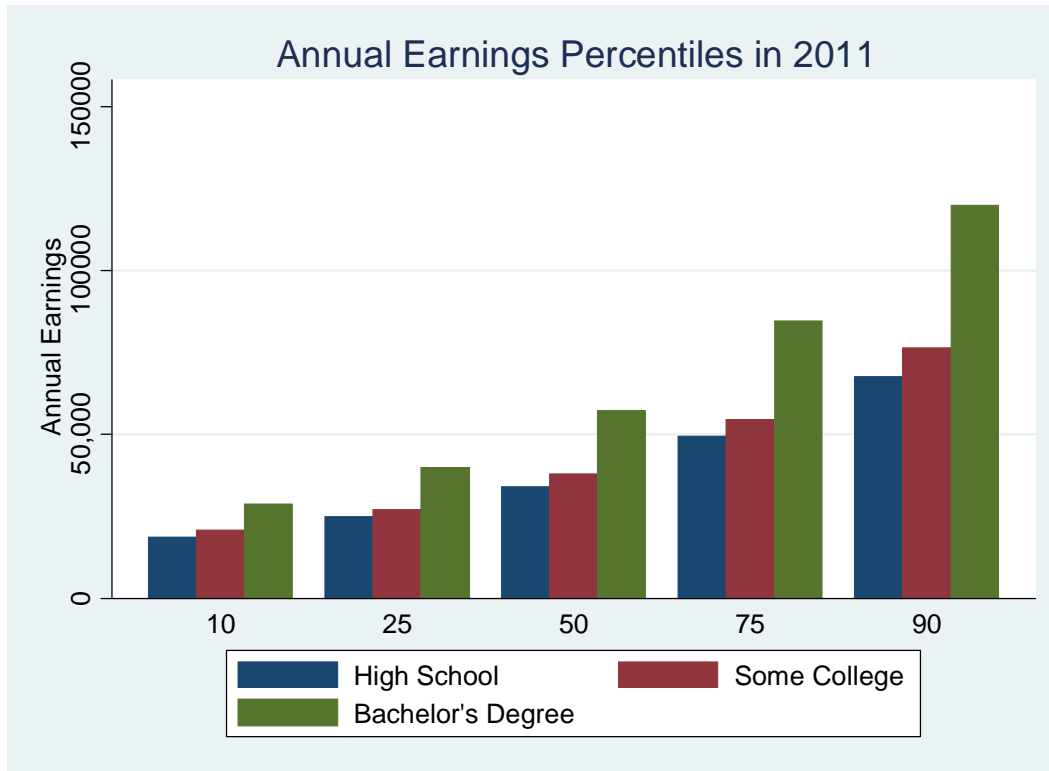
Figure 3



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

Notes: Sample consists of full-time workers between ages 30-50. The college to high school premium is calculated as the average earnings for those with a BA or more divided by the average earnings of those with only a high school degree, minus one. The college to some college premium is calculated as the average earnings for those with a BA 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. Post 1992 we use highest degree attained as level of education. Prior to 1992, those with exactly 12 years of completed education are classified as high school, those with more than 12 but less than 16 are classified as some college, and those with 16 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 .

Figure 4



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

Notes: The sample is restricted to full-time workers between ages 30-50. Some College consists of individuals who reported completing anywhere between one and four or more years of college but did not obtain a degree.