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Dropouts, Taxes and Risk:

The Economic Return to College under Realistic Assumptions

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Abstract: Most published estimates of the economic return to college rest on a series of best-case assumptions that often overstate returns and, most importantly, obscure differences in return across different institutions. We simulate the economic return to college under more realistic assumptions using U.S. Census data combined with administrative data from the more selective University of California system and the less selective California State University system. Specifically, we adjust for delayed graduations, the probability of dropping out, progressive taxes on earned income, and risk aversion. We perform a bounding exercise for ability bias. These each reduce expected returns to a Bachelor's degree. We also find that the college investment has become riskier over time, a change standard estimates ignore. Returns are particularly modest for young men at the less-selective CSU system, largely due to high dropout rates, delayed graduation, and a lower effect on labor force participation compared to women. Our analysis begins to bridge the gap between standard estimates of the economic return to college and the institutional differences reported in Obama Administration's College Report Card.

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After a 35-year climb, the fraction of high school graduates who go on to college appears to be leveling off. In 2013, 65.9 percent of graduating high school seniors enrolled in a two or four year college, a level only modestly above the percentage in the early 1990s.[2] Weak enrollment growth is consistent with the significant fraction of the public who now questions whether college is still worth its cost.[3] Many economists have described these developments as economically irrational given the many economic studies demonstrating that college today remains an excellent investment – in popular discussion, a ticket to the middle class (Autor 2014; Avery and Turner 2012; Daly and Bengali 2014; Greenstone and Looney 2012).

We argue that published estimates of the economic return to college are worth a closer look because virtually all estimates use a set of best-case assumptions. Applying more realistic assumptions, we show that many students—particularly young men who cannot access top-tier universities—face an economic return to college that, while positive on average, can reasonably inspire caution among students and their parents.

To make this case, we simulate the economic return to college based on Mincerian wage regressions of U.S. Census data combined with administrative data from the more selective University of California system and the less selective California State University system.[4] Taken together, the two systems educate a relatively large share of California's

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[2] For recent data, see Floyd Norris, "Fewer U.S. Graduates Opt for College After High School," *New York Times,* April 25, 2014. http://www.nytimes.com/2014/04/26/business/fewer-us-high-school-graduates-opt-for-college.html.

[3] The Heartland Voice, "Heartland Monitor XIX: The American Economy," November 22, 2013, accessed June 9, 2014, http://www.theheartlandvoice.com/insights/heartland-monitor-xix-the-american-economy.

[4] Formerly the California State College System

Bachelor's degree graduates (about 70 percent), and tuition and graduation statistics are readily available. These data, detailed in Section III, allow us to estimate the economic return to students in top tier and second tiear systems starting in 1980 – a time when the economic return to college was at its nadir (Freeman, 1976). The data also permit estimating the economic return from both an individual and a social perspective.

While our calculations focus on California, prior research suggests that the pattern we identify—the gap in returns between top tier and second tier systems—is a national issue and is potentially exacerbated by limited resources at second tier institutions. By focusing on the differences between our estimates and the "best case" returns, we highlight how institutions of higher education can improve their investment value to their students.

I. Building a Best Case

Describing high school seniors and their parents as irrational assumes that published estimates of the large economic return to college (hereafter the ERC) are correct. The assumption is open to question since virtually all of these estimates use most or all of five best-case assumptions.

No Dropouts. ERC estimates are typically based on the college wage premium, the earnings gap between persons who complete a Bachelor's degree and persons whose education stopped at high school. A high school senior considering college should also consider the probability of enrolling in college and dropping out before completing a degree. This probability varies by institution. In the University of California system (UC) 80 percent of entering freshmen complete a degree within six years.[5] Among the 34,000

[5] Data come from Figure 4.1 in the University of California: "*Annual Accountability Report: 2011"* available at http://accountability.universityofcalifornia.edu/documents/accountabilityreport11.pdf

freshmen who entered the CSU system in 1997, only 35.3 percent earned a degree in 4 years, and only 62.8 percent earned a degree within 12 years.[6] Census statistics indicate that college dropouts – individuals described as having "some college" but no degree – typically earn less per year than college graduates (Greenstone and Looney 2013). This suggests a lower return on the college investment but the experience of dropouts is not counted in standard ERC estimates.

A Degree in Four Years. ERC estimates typically assume a student completes the bachelor's degree in four years (Avery and Turner, op. cit.). For students who complete a degree, median years to completion in the UC system is four years but it is five years (nearly six) in the CSU system. A report by Complete College America (2014) finds that, among 580 US public four- year institutions, only 50 report four-year graduation rates above 50%. Delayed completion raises total tuition costs and foregone income, reducing the ERC.

The Use of Pre-Tax Earnings. ERC estimates typically measure the college wage premium using pre-tax earnings .[7] Pre-tax earnings are an appropriate measure of social benefit (see Appendix A for an analysis) but the cost of college, whether paid by students or parents, is made from after-tax earnings. Ignoring taxes overstates the ERC as seen by the individual.

No Ability Bias. Most, but not all, estimates of the ERC assume no ability bias: an assumption that the college earnings premium comes entirely from what is learned in college or a sheepskin effect rather than the higher ability of students who are accepted to

[6] Data come from Tables 133 and 140 in the California State University Statistical Abstract 2009–2010, available at http://www.calstate.edu/AS/stat_abstract/stat0910/index.shtml.

[7] An exception is Heckman, Lochner, and Todd 2008, who adjust for taxes.

college. To the extent that college graduate earnings reflect the individual's higher ability, prior studies overstate the earnings premium from attending college.[8]

Risk Neutrality. Most published studies of the ERC report a single rate of return as if it were risk free. In reality, the reported rate is the average experience of a group of students, each with a somewhat different return depending on whether they graduate, whether they enter a high paying or a low paying field, the state of the economy when they graduate and so on. If the average ERC remains constant but the variability increases, college may become less attractive particularly to families unable to absorb downside risk.

By making best-case assumptions, published estimates of the ERC potentially overstate the ERC facing high school seniors—particularly seniors considering the CSU system. For this reason, the simulations that follow are calculated separately for the UC and CSU systems. The estimates adjust for the possibility of dropping out, actual time to degree, and the effect of taxes. Rather than impose assumptions on ability bias, we perform a bounding exercise by calculating how much of the gap between college and high school graduates would need to be explained by ability for college to be a poor investment. Finally we demonstrate how, under one definition of risk, both the UC and CSU systems have became riskier investments between 2000 and 2010

While our estimates focus on California, papers by economists John Bound, Michael F. Lovenheim and Sarah Turner (2010, 2012) show that similar distinctions between higher and lower tier campuses now exist nationwide. In recent years, the fraction of freshmen in four-year institutions who ultimately complete a Bachelor's degree has fallen while the average time-to-degree (for those who complete a degree) has risen. As

[8] The most cited study on ability bias is Card (1999) who finds little of the college wage premium reflects individual ability differences.

these papers show, both trends are concentrated among students in the "non-top 50" public universities. The authors also show that mathematics test scores of entering students in the "non-top 50" public universities have risen slightly over time suggesting that neither rising dropout rates nor longer time-to-completion reflects declining freshman quality. Rather, a significant fraction of both trends appears to be driven by stretched resources in second tier campuses: enrollments that increase faster than spending making it harder to enroll in required classes, harder to get academic help, and so on.

II. Estimating the Individual's Economic Return to Pursuing a Bachelor's Degree

We simulate the ERC - formally the Internal Rate of Return on the student's investment - to pursuing a Bachelor's degree in either system from the perspective of an 18-year-old student who is graduating from high school and deciding whether to pursue college. We assume the student chooses to enter as an average matriculant and enjoys no private information that would affect expected future earnings, including: the likelihood of completing a degree, the time to completion, and the choice of major. Figure 1 illustrates three paths.[9]

[Figure 1 about here]

- Path A: The student completes a Bachelor's degree (Probability = $P_{completion}$) in N years. She then works until age 65 at the after-tax earnings of a college graduate (with no graduate school). The costs of this path include N years of tuition and foregone earnings[10], while the benefits are annual college earnings after taxes.

[9] To simplify the analysis, we do not consider alternative paths, such as community college or beginning college midcareer.

[10] The full cost of college to the individual includes tuition and fees (net of fellowship income) as well as foregone earnings while attending school. Most published estimates of the ERC use this definition.

- Path B: The senior pursues a Bachelor's degree but drops out after *M* years (Probability = $1 - P_{completion} = P_{drop\ out}$) without earning a degree. She then works until age 65 at the after-tax earnings of persons with "some college." The costs of this path include *M* years of tuition and foregone earnings, and the benefits are the annual after-tax earnings for persons with "some college."
- Path C: The senior foregoes college and works until age 65 at the after-tax earnings of a high school graduate. In calculating the internal rate of return (IRR), Path C is the baseline against which college attendance is compared.

In our simulations, the benefit from pursuing a Bachelor's degree is the expected value of two streams—Path A if the student completes a degree (weighted by the probability of completion) and Path B if the student fails to complete (weighted by the probability of dropping out). The student compares this benefit against the stream of earnings from going directly to work. The net present value (NPV) of pursuing a Bachelor's degree rather than going directly to work can be written as follows:

(1) $NPV(BA) = (P_{completion}) \times NPV(\text{Path A}) + (P_{drop\ out}) \times NPV(\text{Path B}) - NPV(\text{Path C})$,

where NPV (BA) refers to a path's discounted sum of future benefits and costs.

We define the Internal Rate of Return (IRR) of pursuing a Bachelor's degree as the value of the discount rate that sets NPV(BA) in Equation 1 equal to zero—the interest rate that makes the investment in college just break even.

III. Data

Data come from UC, CSU and data on California households collected in the US Census and American Community Survey. California's higher education master plan directs its nine UC campuses and twenty-three CSU campuses to admit students from the

top 12.5 percent and top 33 percent of California high school graduates, respectively. The UC system spends about twice as much per student and has higher average graduation rates and shorter average time to graduation than the CSU system.

[Table 1 about here}

Based on limited data, UC graduates appear to have higher average earnings than CSU graduates. At the same time, the UC system charges higher in-state tuition than the CSU system (Figure 2). Despite recent tuition increases, in-state tuitions for both the UC and CSU systems are roughly in line with in-state tuitions in other public institutions and well below the average tuition charged by private and nonprofit institutions.

[Figure 2 about here]

IRR estimates depend on expected future earnings. We assume the high school senior equates future earnings to contemporary median earnings of workers of different ages.[11, 12] Implementing this behavior requires specifying whose earnings are counted in calculating the median —in particular, how we count persons who have no earnings during the year because they cannot find work, are unable to work, or are voluntarily out of the

[11] For example, an 18-year-old female who making her college decision in 2010 would assume that if she obtained a Bachelor's degree, her earnings at age 30 would be the same as the median earnings of 30-year-old woman with a Bachelor's degree in the year 2010. This is equivalent to assuming that there will be no economy-wide wage growth that would cause age-earnings profiles to shift upward. Based on the last two decades of data, this is a reasonable assumption for college graduate earnings and a mildly optimistic assumption for high school graduates whose earnings have fallen since 1990 (see Figure 1).

[12] Annual earnings involve wages but also annual hours of work that are potentially subject to labor supply decisions particularly in the case of women. Alternatively, expectations of future earnings might be based only on wages but this would ignore the higher unemployment rates of less educated workers.

labor force.[13] For labor force participants, we estimate the median earnings of Californians who have at least $1,000 of earnings during the year and multiply that by the labor force participation rate for that combination of age, sex, and education level. Examples of these age-earnings profiles are shown in Figure 3.[14] For 1980, 1990, and 2000, the U.S. Decennial Census provides sufficient data to estimate age-earnings profiles for the California labor market. After 2000, we rely on the American Community Survey (ACS) from 2005 to 2010, a period that covers both prerecession and recession observations. To estimate differences in UC and CSU earnings, we use a Payscale.com salary survey that estimates that UC graduates earn 10 percent more than CSU graduates. We incorporate this difference into our calculations.[15]

[Figure 3 about here]

Other variables necessary to calculate the IRR are taken from reports of the UC and CSU systems and are detailed in Table 1. To simplify calculations, we equate the

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[13] The data sets we use do not permit easily distinguishing among these groups.

[14] We smooth the age-earnings profiles by estimating a median earnings regression with a quadratic term for age.

[15] The survey was performed by Payscale.com (http://www.payscale.com/college-salary-report-2013/west-coast-schools) based on currently employed workers with a bachelor's degree (no graduate work). This should not be interpreted as a causal estimate but merely an estimation of a difference in means. The earnings difference likely reflects both UC's higher average admission standards and expenditures per student. Large variations remain in both individual outcomes within schools and school outcomes across the systems. The age-earnings profiles in Figure 3 are based on Census data and therefore are representative of Bachelor's degree holders in the California labor market. Estimating an individual's IRR also requires estimating the individual's foregone earnings while in college. For students of a specific age (18, 19, etc.) and gender in a specific year (1980, 1990), we define foregone earnings as the difference between the median earnings of high school graduates who are not in school and the median (part-time) earnings of students who are in college. In this calculation, the median earnings of high school graduates are estimated on California data, but the median earnings of students while in college are estimated from national data because the number of observations in California is too small.

probability of dropping out to the probability of not earning a bachelor's degree within six years.[16] Table 1 shows the longer completion times and significantly higher dropout probabilities in the CSU system.

IV. The Individual's IRR of Pursuing a Bachelor's Degree

Table 2 shows estimates of the individual real IRR for the UC and CSU systems. [17].

[Table 2 about here]

While the real IRR is purged of inflation, student loan interest rates, like other market interest rates, include an adjustment for expected inflation. Correspondingly, Table 2 also includes the *nominal* IRR—the real IRR plus the expected annual rate of inflation over the life of the investment—to allow comparisons with student loan interest rates. Nominal IRR's are fairly constant over time but this is deceptive. Inflation fell sharply between 1980 and 2010 and the constant nominal IRR's are a shifting combination of falling inflation expectations and a rising real IRR.

Three patterns stand out in Table 2:

- In each year, the UC system has a higher IRR than the CSU system for both men and women.
- In each year and within each system, women have a higher IRR than men.

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[16] For students entering the CSU system in 2000, the 10-year completion rate was about 9 percent higher than the 6-year completion rate. For computational simplicity, our calculations ignore a 5 percent difference between the dropout probability of men (higher) and women and we assume all dropouts complete the same number of years of college. See California State University, "First-Time Full-Time Freshmen," Finallyhttp://www.asd.calstate.edu/csrde/ftf/2009htm/sys.htm.

[17] Simulations of the IRR from a societal perspective are contained in Appendix A.

- Over time, real IRRs grow significantly from 1980 through 2000. They decline after 2000 but remain at fairly high levels. This pattern holds for both men and women within each system.

To understand the CSU's lower IRR, recall that the CSU system has both lower admission standards and lower instructional expenditures per student than the UC system. In our simplified model, these factors are captured in CSU's significantly higher dropout rate, its longer time to complete a bachelor's degree (for those who do complete one), and the survey that suggests that CSU graduates with a bachelor's degree earn 10 percent less than UC graduates. CSU's relatively low tuition is not large enough to offset these factors.

The higher IRR for women reflects the relatively large gap in labor force participation rate between women with Bachelor's degrees and women high school graduates. Since 1980, the gap between college and high school hourly wages widened for both women and men, but the gap in *annual earnings* widened faster for women because of the large increase in hours worked among college- educated women.[18]

The third pattern in Table 2 is the rise in the individual's real IRR through 2000 and its subsequent moderate decline. The economic return to college depends on multiple factors, but the dropout rate and time to earn a Bachelor's degree have remained fairly constant within each system (Table 1). As a result, changes in a system's IRR are largely the result of the widening college earnings premium (a positive effect) and rising tuition (a negative effect). Between 1980 and 2000, UC tuition and fees more than doubled from $1,963 to $4,479, and CSU tuition and fees quadrupled from $437 to $1,865 (all figures in

[18] Some part of the difference in labor force participation may be a selection effect in which women who intend to work are more likely to go to college. We view this possibility as one part of ability bias that we discuss in the next section.

2010 dollars). Nonetheless, the college earnings premium expanded so rapidly that the individual's real IRR grew substantially for both systems.

Between 2000 and 2010, this dynamic reversed as the college earnings premium grew more slowly while tuition increased sharply. The real IRR for pursuing a bachelor's degree declined by 7 percentage points for UC women and 2–4 percentage points for all other groups.[19]

In light of these data, was a high school senior entering either system making a good investment? Most studies answer this question using a basic financial rule: If the return on the student's investment - the IRR - exceeds the rate at which the student can borrow, the student should make the investment. To apply this rule, Table 2 shows the 1980 cap on PLUS loans and the unsubsidized Stafford loan interest rate for 1990–2010.[20]

In 1980, a time of extremely high inflation, the nominal IRR for an 18-year-old male matriculating in the CSU system was 13 percent, while the interest rate at which the student could have borrowed was 14 percent. The young man could have attained higher lifetime income by going directly to work.[21] By 1990, the increasing college wage premium together with still-low tuition and lower student loan rates reversed this relationship. By the standard financial rule, college was now a good investment for the average young man in

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[19] In addition, recent increases in the college earnings premium reflect falling wages for high school graduates (Figure 1) rather than rising wages for college graduates. The lack of wage growth for college graduates exacerbates the effect of tuition increases.

[20] The Stafford loan program was initiated in 1988. PLUS loans are secured by the dependent student's parents. On the history of both Stafford and pre-Stafford interest rates, see FinAid, "Historical Interest Rates," http://www.finaid.org/loans/historicalrates.phtml.

[21] As noted earlier, 1980 represented a post-World War II low for the real return on college, the result of both a large supply of college graduates, partially driven by the military draft, and temporarily high blue collar demand in agriculture, energy and manufacturing. By 1985, all these factors had reversed. See Levy (1998) for details.

the CSU system, a situation that continued through 2005–10. For young women considering the CSU system and young men and women considering the UC system, investing in college was a good investment by the standard financial rule in each of the four years. In Appendix A, we show that the individual's pursuit of a BA in either system was also a good investment from society's perspective.

Note in the analysis above that college is a good investment for the individual even after eliminating three of five best-case assumptions described earlier. For each university system in each year, the IRR calculations in Table 2 include the probability of dropping out and they use the true median time-to-degree (for those who graduate), rather than assume four years. The calculations also adjust individual earnings for taxes paid. As a result, estimated IRR's, while positive for both systems, are lower than many published estimates of the ERC.[22]

The analysis retains two other best-case assumptions. First, it assumes no ability bias. If ability bias is present, part of the college-high school wage premium reflects the higher ability of students accepted to college rather than the education alone. It overstates the student's gain from attending college and the student's IRR is lower than the estimates in Table 2.[23]

Second, the analysis assumes that the nominal IRR for each group in Table 2 - e.g. the 10.6% for male freshmen in the CSU system in 2010 – is a single, risk free return on

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[22] As one example, Greenstone and Looney (2012) estimate a real IRR for the average U.S. college student without these corrections and show a real IRR of roughly 16 percent, 2 to 3 percentage points higher than the estimated IRRs in Table 2 for women and 4 to 7 percentage points higher than the estimated IRRs in Table 2 for men.

[23] Consider a student who is accepted to college but decides to go directly to work. Because the student has relatively high ability, he should earn more than the average high school graduate earns. This reduces the extra amount he would have earned by going to college.

their investment. In reality, the 10.6% IRR is an *average* return for the group with roughly half of the group having higher-than-average returns and half having lower.

Relaxing either assumption means considering individual students who have IRR's below those in Table 2. [24] The question is whether the reduced IRR turns college into a bad investment for the students in question. We explore this question in the next two sections.

V. Ability Bias

Since universities screen their applicants for ability, part of the college earnings premium may reflect greater ability among college graduates rather than the causal effect of college on earnings. As a result, the standard estimate of the economic gain from attending college and the resulting IRR will be overstated[25]. Rather than imposing an assumption regarding what percentage of the college earnings premium must be attributed to the individual ability, we perform a bounding exercise to examine what this percentage must be for college to no longer be a good investment—for the IRR to pursuing a Bachelor's degree to be reduced to the interest rate charged by student loans.

[Table 3 about here]

Table 3 shows estimates of these percentages of the college premium for men and women in both the UC and CSU systems between 1980 and 2005–10. Consider the data for 2005–10. In 2010, the unsubsidized Stafford loan rate was 6.8 percent. Women entering the CSU system faced a nominal IRR of 13.1 percent, more than 6 percentage points above the Stafford loan rate, and therefore at least 76 percent of the college earnings premium would

[24] In the case of risk, we expect roughly half of all freshmen will have a return on education below the nominal IRR in Table 2. When we consider ability bias, we are assuming every group's nominal IRR in Table 2 is somewhat overstated.

[25] A student with average ability among college graduates would be expected to earn an average college wage but he would have earned a higher than average high school wage if he had not attended college.

have to be attributed to ability for CSU to be a bad investment for the average woman in this group. Similarly, for men and women entering the higher tuition UC system, roughly 60 percent of the college earnings premium would have to be attributed to ability to make college a bad investment. These bounds are much higher than prior published estimates. For instance, Zimmerman (2013) uses admissions cutoffs to examine the causal effect of college matriculation among marginal college students in Florida. This study and other research suggest that the ability bias is small (see Card 1999 for a review).[26]

Males entering the CSU system in 2005-10 faced a nominal IRR of 10.6 percent—roughly 4 percent above the Stafford loan rate. If at least 36 percent of this gap reflected individual ability—a more plausible fraction—attending CSU would not be a good investment for the average man in this group. The result is consistent with lagging college attainment for young men (Autor and Wasserman 2013).

To summarize, the numbers in Tables 3 indicate that for men in the UC system and women in both systems, over 60 percent of the wage gap must reflect individual ability for college to be a bad investment. Men in the CSU system are the exception: a modest degree of ability bias is enough to raise a note of caution about the wisdom of matriculating. We return to this point in the concluding section. (In Appendix A, we show that the individual's pursuit of a BA in either system remains a good investment for society after accounting for ability bias.)

VI. The Individual's Risk of Financial Distress After College

[26] Nonetheless, conversations with California legislative staff in spring 2012 suggest that they believe the bias is large and that published estimates of the IRR of a Bachelor's degree are significantly overstated.

Most published estimates of the ERC ignore the investment's risk. They report a single IRR that assumes students graduate on time and earn the average of individuals of the same age and with the same education. In reality, a significant fraction of freshmen, particularly in the CSU system, leave an institution without a degree and many of those who earn a Bachelor's degree take more than four years to do so. Upon graduation,, students who do earn a degree face a wide distribution of post-college earnings. Given these uncertainties, we examine the proposition that although the *mean* economic return on pursuing a Bachelor's degree exceeds the interest rate on student loans, the investment's risk has increased as tuitions have grown and as the wages of some younger workers have suffered in the recent recession (Beaudry, Green, and Sand 2013).

To simplify the discussion, we first examine a particular form of risk: the likelihood that earnings among college graduates will be sufficiently low that these individuals would fall into financial distress. This definition of risk incorporates both wage levels and wage variation.

To estimate this likelihood, we begin Avery and Turner's conclusion that monthly student loan repayments in the range of 10–11 percent of monthly income should be "manageable" (Avery and Turner op cit, pp. 186–87). Extending this definition, we denote financial distress as having student loan repayments in excess of 15 percent of income. Figures from the Project on Student Debt indicate that roughly half of all graduating seniors on UC and CSU campuses have student loans and a typical loan balance equals roughly two years worth of a system's tuition.[27]

[27] See the analysis for California campuses at http://projectonstudentdebt.org/state_by_state-data.php

To illustrate how risk has changed, we consider the case of a 30-year-old who enrolled in college at age 18. Specifically:

- The student then either dropped out of college after two years or graduated from college in the median time-to-degree which varies by system attended and year of attendance (Table 1).
- Upon leaving college, the student had a loan balance equal to two years of tuition if the student graduated and one year of tuition if the student dropped out where tuition varies by the system attended and year of attendance (Figure 2).
- While the student was in college, his/her student loans accrued no interest. Upon graduation, the loans accrued interest at the unsubsidized student loan rate in force at that time.
- Once out of college, the individual repaid student loans using the 10-year schedule required by the Stafford student loan program.

Our measure of risk is the probability that this 30-year-old individual has a loan repayment that exceeds 15 percent of her earnings—a probability that we estimate based on the variation in earnings among 30-year-olds in the year the individual turns 30.

Table 4 contains estimates of this measure for men and women in both the UC and CSU systems between 1980 and 2010. Consider a 30-year-old man in 1990 who had borrowed two years' worth of tuition to earn a Bachelor's degree at a CSU campus (for the moment, we ignore the possibility that the individual dropped out). He would have left college with about $2,090 in total debt (in 2010 dollars). Assuming the individual was repaying this loan over 10 years, he would have been facing loan repayments of about $32 per month. By our 15 percent criteria, the individual would have had to be earning at least

$212 per month—roughly $1.30 per hour in full-time work—to avoid financial distress. Given the earnings distributions of 30-year-old male college graduates in 1990, the chance for a working male college graduate to have earnings this low was virtually nil, and therefore the risk of experiencing financial distress was zero. Adding the possibility of dropping out of college does not change the conclusion: in this 1990 calculation the lower earnings of college dropouts are largely offset by their fewer years of tuition debt.

[Table 4 here]

For students in the CSU system, the risk of financial distress remained essentially zero through 2010. The UC system with substantially higher tuition had zero risk of financial distress through 1990, but the risk began to rise, particularly for women, beginning in 2000. In 2010, under our simplified example, the probability of being in financial distress at age 30 was .07 for male UC freshmen and .16 for female UC students large enough to attract an applicant's attention.

The probabilities in Table 4 illustrate an important point: the risk of investing in a Bachelor's degree can increase (and almost certainly has increased), even though the IRR of investing in a Bachelor's degree remains high. Recall that our estimates of the individual's IRR (Table 2) are based on each group's median earnings (as are virtually all published estimates). Recessions, however, affect individuals unequally, and therefore the hardest-hit college graduates have very low earnings even as the median college graduate's earnings have fallen less dramatically. Data on the distribution of usual weekly earnings indicate that between 2000 and 2010, median weekly earnings among 25- to-34 year-old men with a Bachelor's degree fell by 7 percent (adjusted for inflation), while earnings of men at the 25th percentile of the distribution fell by 13 percent and earnings of men at the

10th percentile fell by 17 percent. Thus, modest changes in median earnings obscure a growing number of recent college graduates with low earnings who may have trouble repaying loans.

At first glance, any fall in the median earnings of college graduates appears incompatible with the still-high IRR to pursuing a Bachelor's degree. In recent years, however, the college earnings premium and the IRR have remained high because high school graduates' earnings have fallen, not because college graduates' earnings have risen (e.g., see Figure 3). Because of declining earnings among high school graduates, pursuing a Bachelor's degree remains a good investment for the average admitted student despite rising tuition. But the absence of growth in college graduates' earnings combined with rising tuition means the investment carries an increased risk of financial distress.[28]

Since the early 1990s, students with federally backed loans have been able to mitigate this risk by choosing income-contingent loan repayment plans. Until very recently, however, take-up of these plans has been limited (Chopra 2013, Franke-Ruta, 2013).

VII. Conclusion

From a student's perspective, the cost of attending any college, including the cost of foregone earnings, is a big investment. U.S. colleges vary widely in quality including their ability to help students graduate in a timely fashion. In this context, it is not "irrational" for students and parents to be skeptical about published estimates of the economic return to college (ERC) that imply the same high rate of return for all institutions. To the contrary,

[28] For similar reasons, the probability of financial distress is higher for women than for men even though women have the higher IRR. Women's higher IRR reflects the large earnings gap between women college graduates and women high school graduates. But women's earnings are lower than men's earnings, and so women potentially have greater difficulty than men in paying off student loans.

skepticism is warranted since typical estimates of the ERC make extensive use of best-case assumptions.

Applying more realistic assumptions using earnings data from the U.S. and administrative data from the University of California (UC) and California State University (CSU) systems, we develop three main conclusions:

- Despite tuition increases, pursuing a Bachelor's degree in 2010 was still a good investment for the median man or woman in the UC system and the median woman in the CSU system. For each of these groups the ERC was not as high in 2010 as it was in 2000.
- As the ERC to college declined after 2000, the Bachelor's degree became only a marginally good investment for men entering the CSU system.
- Investing in some colleges carried more risk in 2010 than in earlier decades. In 2000 and earlier, there was a miniscule probability that an entering male or female freshman in either system would eventually have difficulty repaying a student loan. By 2010, rising tuition and a deteriorating market for college graduates increased the probability of repayment difficulties among UC graduates with debt to about 7 percent (males) and 15 percent (females), large enough to pose a significant risk for families with limited resources. For students from the lower tuition CSU system, debt risks remained minimal.

To the extent a student receives fellowship aid and/or participates in the federal income-contingent repayment plan, college is a better investment than these conclusions suggest. To the extent that students face continued tuition increases, the college investment will be worse.

While our simulations are based on California data, the work of Bound, Lovenheim and Turner (2010, 2012) suggest similar ERC differences among institutions exist nationwide. At the same time, we show in Appendix A that the individual's pursuit of a BA in both the UC and CSU system remains a good investment from society's perspective even after reasonable adjustments for ability bias.

A number of researchers have pointed to the need for more college graduates both to advance individual economic mobility and to raise the quality of the U.S. labor force (e.g. Autor, 2014). The simulations in this paper are a natural extension of the Obama Administration's attempts to develop a College Scorecard (http://www.whitehouse.gov/issues/education/higher-education/college-score-card) . By reporting tuition, the six-year graduation rate, typical levels of student borrowing and, eventually, some data on post-college employment, the Scorecard seeks to highlight institutional differences that potentially affect a student's ERC. We take the next step in this paper by simulating examples of the ERC as it varies across different college systems. These simulations begin to close the gap between the large institutional variations shown in the College Scorecard and the most published studies that report a single, high economic return to college. If estimates of institutional variations in the ERC continue to improve, they will increase the quality of student decisions and penalize institutions for such problems as high dropout rates.

College remains a good investment for both many individuals and the state, but it is a stepping stone—not a ticket—to the middle class. As such, it deserves the scrutiny that an individual would give to any risky investment.

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TABLES

TABLE 1. Parameter Values for IRR Calculations (both males and females)

	1980	1990	2000	2005-10
Six Year Graduation Rate				
University of California	65%	75%	80%	80%
California State University	40%	42%	48%	48%
Drop Out Rate				
University of California	35%	25%	20%	20%
California State University	60%	58%	52%	52%
Median Years to Completion				
University of California	5	5	4	4
California State University	5	5	5	5
Years Attended by Drop-Outs[1]				
University of California	2	2	2	2
California State University	2	2	2	2
Tuition and Fees				
University of California	$1,902	$2,709	$4,342	$10,302
California State University	$262	$1,301	$1,808	$4,335
Mean Tax Rate[2]				
High School	20%	18%	17%	14%
Some College	22%	20%	20%	17%
Bachelor's Degree	23%	23%	23%	19%

[1] Data was not available; this is an assumed value.

[2] Approximated using the NBER TaxSim Model, using earnings of median earner by year and level of education.

TABLE 2. Individual's IRR of Pursuing a Bachelor's Degree

	Men				Women			
	1980	1990	2000	2005-10	1980	1990	2000	2005-10
CSU System IRR								
Real Return	4.2%	4.0%	11.3%	9.2%	9.9%	12.2%	16.4%	13.1%
Nominal Return	13.0%	10.2%	13.7%	10.6%	18.7%	18.4%	18.9%	14.5%
UC System IRR								
Real Return	10.4%	11.8%	16.3%	12.7%	11.3%	14.5%	20.7%	14.4%
Nominal Return	18.0%	18.0%	18.8%	14.1%	20.1%	20.7%	23.2%	15.8%
Unsubsidized Stafford Rate	14%*	8.0%	8.2%	6.8%	14%*	8.0%	8.2%	6.8%

* Cap rate on PLUS loans.

TABLE 3. Percentage of College Premium Attributed to Ability for College to be Poor Individual Investment

	Men				Women			
	1980	1990	2000	2005-10	1980	1990	2000	2005-10
CSU System								
Nominal IRR	13.00%	10.20%	13.70%	10.60%	9.90%	12.20%	16.40%	13.10%
Percentage of Bachelor's Degree Premium Due to Ability to Make Bachelor's degree a Bad Investment	NA*	25.00%	48.00%	36.00%	36.00%	80.00%	74.00%	76.00%
UC System								
Nominal IRR	18.00%	18.00%	18.80%	14.10%	20.10%	20.70%	23.20%	15.80%
Percentage of Bachelor's Degree Premium Due to Ability to Make Bachelor's degree a Bad Investment	52.00%	75.00%	67.00%	56.00%	52.00%	83.00%	78.00%	62.00%

* CSU men in 1980 represented a bad investment even if 100 percent of the education premium was attributed to college.

Table 4. Probability of Entering Financial Distress

	Year Entering College (Men)				Year Entering College (Women)			
	1980	1990	2000	2005-10	1980	1990	2000	2005-10
CSU System	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%
UC System	0.0%	0.0%	1.0%	16.0%	0.0%	0.0%	2.0%	16.0%

Note: We define financial distress as having student loan repayments in excess of 15 percent of income at age 30.

Appendix Table A. Social IRR of Pursuing a Bachelor's Degree

	Men				Women			
	1980	1990	2000	2005-10	1980	1990	2000	2005-10
CSU System IRR								
Real Return	-2.3%	-4.9%	7.0%	7.1%	2.4%	7.8%	10.8%	10.2%
Nominal Return	6.5%	1.4%	9.5%	8.5%	11.2%	14.0%	13.3%	11.6%
UC System IRR								
Real Return	3.1%	5.2%	9.0%	9.1%	3.3%	7.2%	11.3%	10.1%
Nominal Return	11.9%	11.4%	11.4%	10.5%	12.1%	13.4%	13.7%	11.5%
Both Systems								
Nominal Interest Rate on 20-Year Municipal Bond	7.4%	7.2%	6.1%	3.75%	7.4%	7.2%	6.1%	3.7%
Nominal Interest Rate on Stafford Loans	14%*	8.0%	8.2%	6.8%	14%*	8.0%	8.2%	6.8%

Appendix Table B. Percentage of College Premium Attributed to Ability for College to be a Bad Social Investment

	Men				Women			
	1980	1990	2000	2005-10	1980	1990	2000	2005-10
CSU System								
Nominal Social IRR	6.50%	1.40%	9.50%	8.50%	11.20%	14.00%	13.30%	11.60%
State/Local Bond Nominal Interest Rate	7.40%	7.20%	6.10%	3.80%	7.40%	7.20%	6.10%	3.80%
Percentage of Bachelor's degree Premium Due to Ability to Make BA a Bad Investment	NA	NA	40%	53%	50%	72%	68%	69%
UC System								
Nominal Social IRR	11.90%	11.40%	11.40%	10.50%	12.10%	13.40%	13.70%	11.50%
State/Local Bond Nominal Interest Rate	7.4%	7.20%	6.10%	3.80%	7.4%*	7.20%	6.10%	3.80%
Percentage of Bachelor's degree Premium Due to Ability to Make BA a Bad Investment	70%	55%	47%	60%	65%	68%	67%	67%

FIGURES

Figure 1. The Decision to Pursue a Bachelor's Degree

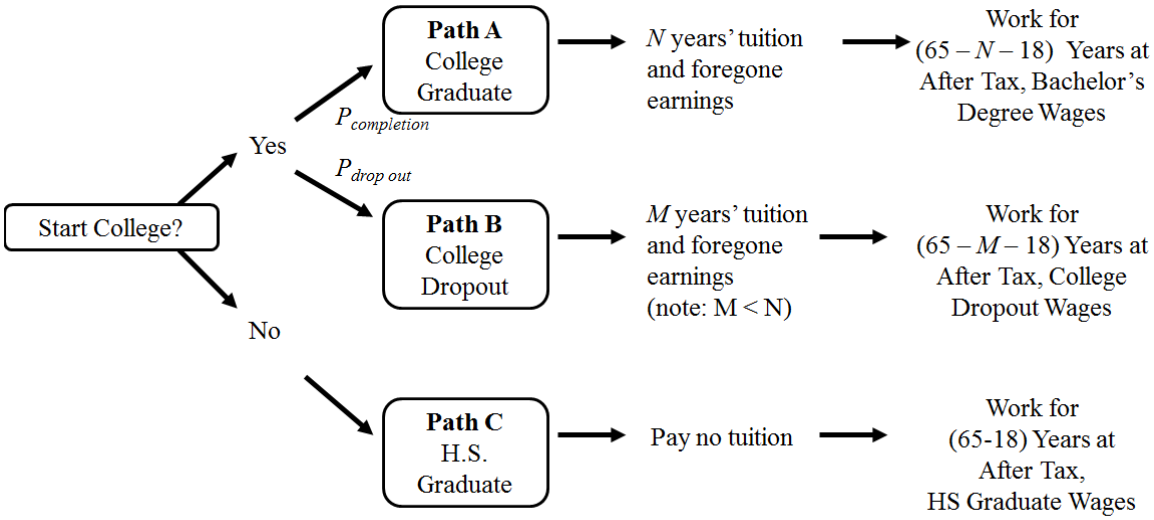


Figure 2: Tuition and Fees, Cost of Instruction: UC and CSU Systems (2010 Dollars)

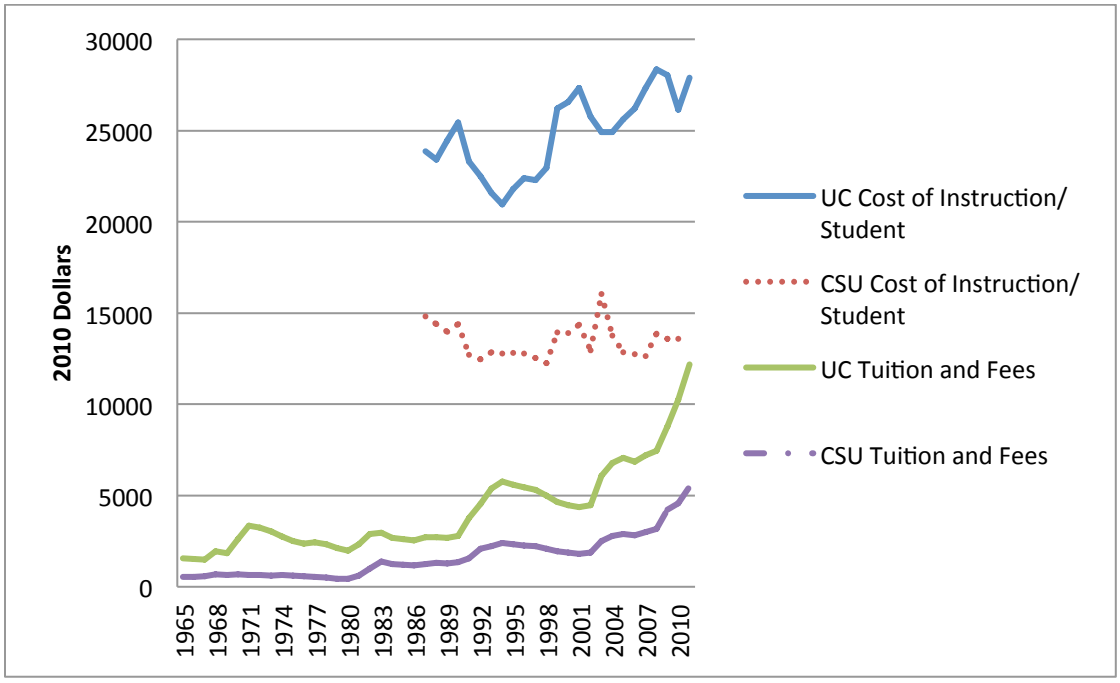
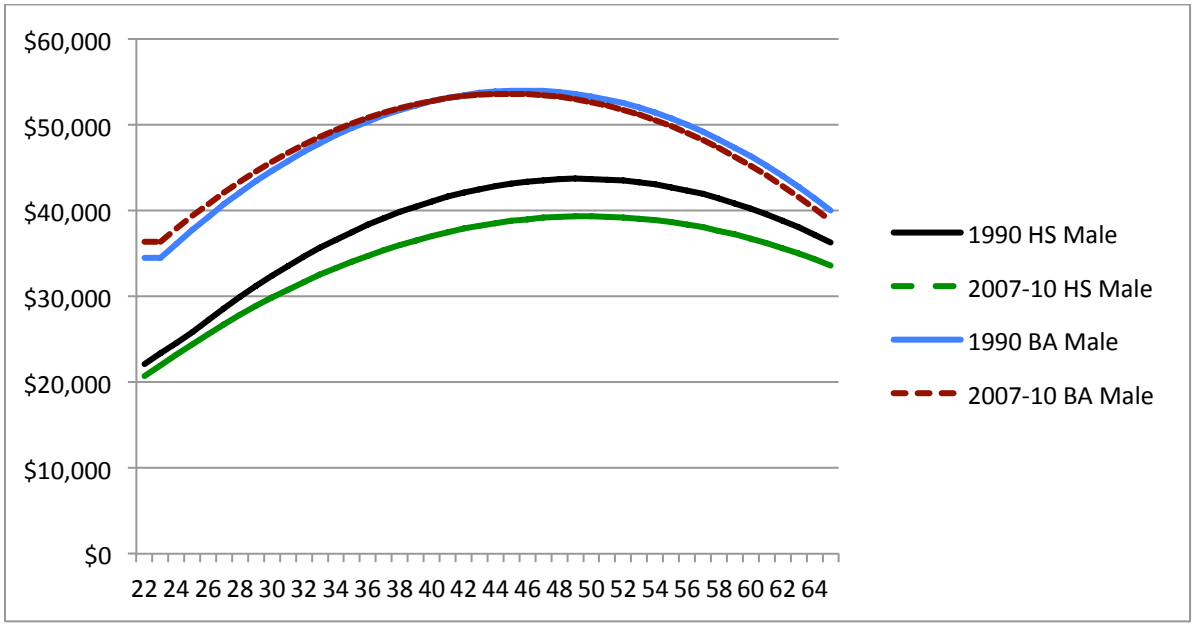


Figure 3: California Male Age Earnings Profiles by Education, 1990 and 2010 (2010 Dollars)



Appendix A

Society's IRR for the Individual's Pursuit of a Bachelor's Degree

Appendix Table A contains estimates of society's real IRR when an individual pursues a Bachelor's degree. On the cost side, this calculation includes the total cost of instruction rather than only the individual's tuition. On the returns side, this calculation includes pretax earnings rather than post-tax earnings.

Judging the pursuit of a Bachelor's degree from society's perspective also requires a change in the investment standard. From society's perspective, the individual's pursuit of a Bachelor's degree is a good investment if the social IRR exceeds the rate at which the larger society can borrow. We approximate this borrowing rate by an average interest rate paid on 20-year state and local bonds.[29]

[Appendix Table A about here]

Moving from the individual's IRR to society's IRR involves two opposing effects. Substituting the full costs of instruction for tuition lowers the estimated IRR. Substituting pretax earnings for after-tax earnings raises the estimated IRR. We find that the negative effect dominates; across all groups, college generates a real IRR for society in 2010 averaging 9.3 percent, about 3 percentage points less than the real IRR seen by the individual. This estimate, however, does not include the social benefits of human capital spillovers, lower incarceration rates, or civic participation. As a result, our exercise may yield a lower bound for the social returns to education (for a review, see Moretti 2005).

This lower bound would seem to justify society's investment. In recent years, interest rates on municipal bonds—society's borrowing rate—has been about 2–3 percentage points

[29] Data are taken from the Federal Reserve Board of Governors, http://www.federalreserve.gov/releases/h15/data.htm.

lower than interest rates on student loans. As a result, the pattern in Appendix Table A is similar to the pattern in Table 2. Men entering the CSU system were not good investments for society in 1980 or 1990 but became good investments in 2000 and 2005–10. Women entering the CSU system and men and women entering the UC system were good investments in society in each of the four years.[30]

[Appendix Table B about here]

Appendix Table B calculates the required attribution of the college premium to ability for college to be a bad investment for society. Although society's IRR is lower than the individual's IRR, the interest rate for state and local bonds is lower than the interest rate on student loans. In particular, even for men in the CSU system, ability has to account for at least 50% of the college wage premium before college becomes a bad investment for society.

[30] Recall that the individual IRR declined sharply between 2000 and 2010, in large part due to the rapid rise in tuition. The social IRR is based on the full cost of instruction per student—not just tuition. Unlike tuition, the cost of instruction per student was relatively constant during the period, which helps to explain why the social IRR did not rise.