



# Ova and out: Using twins to estimate the educational returns to attending a selective college<sup>☆</sup>



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## ABSTRACT

Research has shown that attending a relatively selective four-year college over a less selective alternative is positively related to bachelor's degree completion. This paper revisits that question with a novel dataset of over 11,000 sets of twins in the United States and information on colleges to which they apply, enroll, and potentially graduate. I show that a student's probability of bachelor's degree completion within four years increases by 5 percentage points by choosing an institution with a median SAT score 100 points higher than the alternative. Moreover, the estimated magnitude of impact is insensitive to several methodologies, including OLS, twin fixed effects, and controlling for the application portfolio. This suggests that in certain contexts, sources of bias perceived as barriers to obtaining causal estimates of the returns to college selectivity, such as unobserved family characteristics and student aspiration, may be of little concern.

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## 1. Introduction

Research shows that there is a strong positive relationship between college selectivity and graduation rates (Alon & Tienda, 2005; Bowen & Bok, 1998; Bowen, Chingos, & McPherson, 2009; Horn & Carroll, 2006; Kane, 1998; Long, 2008). Similarly, there is a strong relationship between college selectivity and longer term outcomes such as graduate school attendance (Brand & Halaby, 2006; Eide, Brewer, & Ehrenberg, 1998; Zhang, 2005) and wages (Behrman, Rosensweig, & Taubman, 1996; Brewer, Eide, & Ehrenberg, 1999; Daniel, Black, & Smith, 1997; Hoxby, 1998; James, Alsalam, Conaty, & To, 1989; Kane, 1998; Long, 2008; Loury & Garman, 1995; Monks, 2000). Identifying causal relationships has been more challenging

because selection on student unobservables is likely to bias estimates of the return to selectivity. However, researchers, typically looking at the effect on future wages, have developed compelling identification strategies to overcome the bias. For example, Dale and Krueger (2002, 2011) match students who have similar college application portfolios and acceptances to a highly selective set of institutions, arguing that these students are similar on unobservables. They find that college quality has no impact on future wages.<sup>1</sup> This analysis is replicated and confirmed with a broader set of institutions in Long (2008), who finds that there is a positive impact on the probability of graduating college.<sup>2</sup> Hoekstra (2009) and Saavedra (2008) use a regression discontinuity approach based on admission cutoffs at a single flagship university and in Columbia, respectively, and find that matriculates at the more

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<sup>1</sup> There is a positive impact for minorities and when using net tuition as a measure of quality.

<sup>2</sup> Long (2008) not only uses the Dale and Krueger (2002) method, but also uses propensity score methods from Black and Smith (2004) and an instrumental variables method.

selective universities earn approximately 20 percent more than applicants with scores below the admission threshold. Finally, [Cohodes and Goodman \(2012\)](#) use a regression discontinuity that exploits cut scores for merit scholarships at public universities in Massachusetts. They find that high achieving students who are compelled to enroll in a less selective (public) university than their peers have a 40 percent lower probability of graduating on time.

The aforementioned research has made great progress in controlling for selection bias. However, without the availability of a discontinuity to exploit, additional unobservable family characteristics are still likely to exist in most of the analyses and potentially bias estimates, as noted in [Lindahl and Regner \(2005\)](#). For example, parents may insist that their children attend a selective institution and graduate, regardless of parental income and education or other typical family-level observables. To address this, several researchers have addressed the selection bias related to family background by using twins ([Ashenfelter & Krueger, 1994; Rouse, 1999](#)).<sup>3</sup> In a related paper, [Behrman et al. \(1996\)](#) use female twin data and find that wages are affected by college quality and years of schooling but stop short of suggesting that college quality directly impacts years of schooling.

This paper estimates the effect of attending a relatively selective college on the probability of graduating by using a novel set of twins and a rich set of information on students' application portfolios. Using College Board data, I identify 11,008 sets of twins, who both take the SATs and enroll in a four-year college, by matching students in the same high school, with the same last name, address, and date of birth. This sample size dwarfs previous twin studies, and therefore, I am able to examine heterogeneity in outcomes and to obtain precise estimates. Getting these precise and nuanced estimates is important because from the students' perspective, college is a large time, financial, and human capital investment and they deserve to know the investment's expected return and whether choosing one college over another has higher expected returns. From the policymakers' perspective, college is heavily subsidized and understanding the effect of college selectivity can help allocate resources more efficiently.

As a starting point, I regress whether a student graduates in four years on college selectivity, as measured by the median SAT score of enrollees, controlling for student characteristics and achievement measures and parent characteristics.<sup>4</sup> I find that attending a college that has a median SAT 100 points above the alternative is associated with a 5.8 percentage point increase in graduation probability.

Following [Dale and Krueger \(2002\)](#), I include controls for the number of applications and quality of colleges in the portfolio because there may exist unobservable

differences among students who apply to different sets of colleges, such as aspiration or ability, which may bias estimates. Including these controls reduces the graduation impact estimate slightly to 5.2 percentage points per 100 point median SAT increase. I also match students on application portfolios so as to include portfolio fixed effects, but results are largely unchanged.<sup>5</sup> The robustness of these results, even when including application portfolio controls, is inconsistent with [Long \(2008\)](#), whose OLS estimate of the effect of selectivity on graduation rates is cut in half and not statistically different than zero.

Next, I estimate a twin fixed effects model and find, again, an estimate of 5.2 percentage point improvement in the probability of graduating when enrolling in a school with a median SAT score 100 points greater than the alternative. This result is consistent with previous research on twins, which suggests that controlling for the selection on unobservable family characteristics reduces the magnitude of estimates, but usually by very little ([Ashenfelter & Krueger, 1994; Rouse, 1999](#)). Finally, I combine the twin fixed effects model and include application portfolio controls and find that the estimate is largely unchanged—4.8 percentage point increase in four-year graduation probability per 100 SAT point increase in median SAT.

The large sample size affords me the opportunity to test for nonlinear effects, which do exist: the largest gains in graduation probability occur when choosing moderately selective colleges over less selective colleges, rather than highly selective colleges over moderately selective colleges. Enrolling in a moderately selective college (median SAT between 1100 and 1199) has almost a 10 percentage point graduation advantage relative to enrolling in a less selective college (median SAT below 1100) whereas enrolling in a highly selective college (median SAT above 1199) has an additional 5 percentage point graduation advantage relative to enrolling in a moderately selective college (and a 15 percentage point advantage over less selective colleges). There are few differences in graduation rates within finer gradations of less selective colleges and highly selective colleges.

Next, I test for heterogeneous effects. I find that the relationship between institutional selectivity and four year graduation probability is nearly twice as large for males compared to females. Compared to White students, Black, Hispanic and Asian students are less impacted, in terms of graduation rates, by institutional selectivity. The relationship between institutional selectivity and graduation probability is also larger for students from suburban high schools, compared to their urban and rural counterparts. Finally, I find evidence that undermatching does reduce a student's probability of graduating whereas overmatching has no pronounced effect.<sup>6</sup>

<sup>3</sup> There is a substantial literature on issues that potentially arise when using within twin variation. These are discussed in more detail in Section 3.2.4.

<sup>4</sup> Controls include student SAT, high schools GPA, whether participates in AP, number of SAT2's taken, ethnicity, first language, parental income and education, state residence, local unemployment and education attainment, and cohort.

<sup>5</sup> [Dale and Krueger \(2002\)](#) match on application portfolio and acceptances. The costs and benefits of my approach are discussed in the empirical strategy.

<sup>6</sup> Undermatching is when high ability students enroll in relatively unselective schools. Overmatching is when low ability students enroll in relatively selective schools.

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