

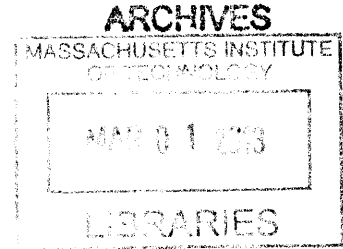
Essays on Housing, Education, and Inequality

by

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Submitted to the Department of Urban Studies and Planning
in Partial Fulfillment of the Requirements for the Degree of

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ABSTRACT

According to standard economic theory, more people will obtain postsecondary education in response to the rising college wage premium. However, students from low income families remain less likely to earn a college degree than high income students, even controlling for academic preparation. My dissertation provides empirical evidence on the puzzle of low college attainment among low income students. First, I estimate the effects of motivational qualities on college graduation by performing multivariate regression analysis using National Education Longitudinal Study data. I find that motivational qualities measured in 8th grade, i.e. causally prior to postsecondary participation, predict college degree completion, independent of grades and demographic characteristics. Further, the positive impact is concentrated among disadvantaged students. Second, I examine if students possess adequate information about college preparation and the application process by conducting observations and over 50 interviews with high school guidance counselors, advisors, and students in public schools serving poor neighborhoods. I find that students are familiar with college applications but they are unaware of their own academic performance and lack context to make effective use of college guidance. Third, I identify the causal effect of college selectivity on degree completion by using National Longitudinal Survey of Youth data and instrumental variable estimation. I find that attendance at selective public universities increases the probability of graduation, controlling for grades and family background. This dissertation contributes to the literature by identifying the role of motivational qualities on college outcomes, increasing our understanding of student information about college, and assessing the impact of college quality on degree completion. The results have important public policy implications: 1) colleges can both improve graduation rates and increase student diversity by attaching more weight to motivation qualities in the admissions process, 2) schools must instill strong academic habits earlier so students can obtain higher grades and benefit from college guidance, and 3) students should enroll in the most selective colleges they are qualified to attend. Understanding the barriers to higher education for low income students is essential for increasing the proportion of college graduates and improving individual socioeconomic mobility, urban revitalization, and national economic competitiveness.

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Essays on Housing, Education, and Inequality

I. Introduction

Why are lower income students less likely to receive a college education than higher income students? Wealthy high school graduates are 30 percentage points more likely to enroll in college and 40 percentage points more likely to finish a bachelor's degree, compared to lower income peers (Ellwood and Kane 2000; Haveman and Wilson 2007). Controlling for school achievement and parental education, poor students are still 8-10 percentage points less likely to attend college; the effect of income appears to be growing over time (Carneiro and Heckman 2003; Ellwood and Kane 2000; Belley and Lochner 2007). The reasons for these income differences in college enrollment and completion are not fully explained by existing theory or empirical work.

The low college participation rates are puzzling because economic theory predicts that individuals will invest in more schooling given the rising returns to postsecondary education (Becker 1964; Borjas 2004). In recent decades, the average earnings for college-educated workers has increased compared to high school-educated workers, due to a slowdown in the rate of growth of the supply of individuals with a college degree (Autor et al. 2008; Goldin and Katz 2008). Yet relatively few lower income students are responding to these financial incentives. Previous work argues that low college attendance is due to market failures or rational decisions (Kane 1999; Heckman 2000). A premise of this dissertation is that the scholarly debate misses crucial variables affecting degree completion, which calls for additional research (Hoxby 2004; Bowen et al. 2009; McPherson and Schapiro 2008).

Understanding college barriers is important for increasing human capital, reducing social inequality, and stimulating economic productivity (Goldin and Katz 2008; Gamoran 2001; Rauch 1993). College graduates earn higher wages (Baum et al. 2010) and display better health (Currie and Moretti 2003) than high school graduates. Finally, increasing the proportion of skilled workers leads to increased local and national productivity (Glaeser and Saiz 2004; Hanushek and Woessmann 2008).

II. Statement of the Problem

Disproportionately Low College Participation among Qualified Lower Income Students

Standard economic theory predicts that college participation will increase in response to the rising value of a bachelor's degree. In practice, however, lower income students, defined here as below median family income, remain less likely to obtain a college education than wealthier students despite a rising college wage premium. The long-standing debate in the scholarly literature focuses on two explanations for the large gaps in college participation by income level: market failures and rational decisions.¹ The failure of the market to provide adequate financing or accurate information to lower income groups could reduce college participation by limiting access. However, lower income students might be making reasoned choices not to pursue higher education if they are ill-prepared to succeed in or benefit from college. Existing studies yield mixed results, so additional research is needed to resolve this debate.

¹ Sociologists have also offered various theories to explain income differences in college enrollment and completion. Status attainment models propose that socioeconomic status affects college aspirations, including college predisposition, search, and choice (Hossler and Gallagher 1987). The student integration model suggests 1) social integration factors, like interacting with faculty or students, and 2) academic integration factors, like test scores, are important indicators of students' experience and likelihood of remaining in school (Tinto 1993). However, the empirical evidence is inconclusive.

This dissertation provides empirical evidence on the puzzle of low college participation among lower income students. I propose and test an alternative explanation: students possess high levels of motivational qualities that predict educational and labor market success, but low standardized test scores limit their postsecondary opportunities. Then, I examine if students have accurate information about college preparation and the application process. Finally, I evaluate market failures due to college mismatches by assessing how the academic performance of qualified students is affected by enrolling in less selective colleges.

The rest of this dissertation proceeds as follows. First, I describe the background for this research: a growing college wage premium has contributed to rising income inequality. Next, I present predictions from economic theory; observed trends that run counter to theory; and reasons why improving college participation is important. The following section describes explanations for the divergence between theory and actual results. Then, I present my research questions. The following chapters consist of the three empirical papers. The final section concludes.

III. Background and Context

Income Inequality Driven by Slowdown in Supply of College Educated Workers

Income inequality has increased in the United States due to changes in the wage structure driven by the changing value of a college education. Since stabilizing in the mid 20th century, the wage difference between the 90th and 10th percentiles has risen steadily, reaching its peak in 2005 (Goldin and Katz 2007; Autor et al. 2008). Most of the increase in wage variance can be attributed to the large growth in the relative earnings of workers with a bachelor's degree (Lemieux 2006; Goldin and Katz 2007; Firpo et al. 2007).

The increased earnings of bachelor's degree holders are primarily due to a relative decline in the rate of growth of the supply of college-educated workers, although shifts in employer demand also play a role. As demand for skilled workers increased during the last half of the 20th century, the supply of college-educated labor kept pace until 1980, when there was a slowdown in the educational attainment of successive cohorts (Goldin and Katz 2008). In addition, skill-biased technological change, declining unionization, and off-shoring of jobs contributed to rising wages for skilled workers and eroding wages for less skilled labor (Autor et al. 2003; Card and DiNardo 2002; Levy and Temin 2007). Although a combination of forces drove up the value of a college degree, economic theory predicts individuals will respond in the same way.

Economic Theory Predicts Increasing College Enrollment and Completion

Standard economic theory posits that evidence of rising returns to education will lead more people to seek and finish more schooling, all other things equal. According to the human capital model, people invest in skills, e.g. by going to school, in order to raise their level of productivity (Becker 1964). Individuals rent these skills to employers in exchange for wages, with firms paying more for more productive workers. In the context of higher education, the human capital model predicts that students will invest, i.e. enroll, in college as long as the net present value of future earnings exceeds the costs of going to college (Borjas 2004). Assuming complete information and no financing constraints, more individuals will attend college and finish a degree in light of the higher wages paid to college-educated workers.

The signaling model also predicts that individuals will pursue more education in response to the rising college wage premium, but for different reasons. According to the signaling model, people acquire education credentials to reveal their abilities to employers, who are faced with

imperfect information about worker productivity (Spence 1973). College attendance need not increase an individual's level of human capital. Instead, the diploma signals that students possess some desired ability by virtue of meeting a college's academic standards. Given the rising college wage premium, we would expect more people to obtain a bachelor's degree according to signaling theory.

Despite different assumptions, the two economic theories generate the same prediction: individuals will pursue more schooling in response to the rising returns to education. Higher wages for college-educated workers should induce more individuals on the margin of attending college to attend and induce more individuals on the margin of finishing a degree to finish. But the observed trends in college participation do not necessarily match the theoretical predictions.

College Enrollment Has Increased Unevenly and Completion Is Slow

Increasing the proportion of the population with a bachelor's degree entails expanding college enrollment or improving college completion, or both.² Despite the rising college wage premium, college attendance among lower income groups has not kept pace. In addition, degree completion rates diverge by income.

College enrollment

Gaps in college entry by family income have always existed, but they appear to be widening in recent years. Compared to 1982, students in 1992 entered college in increasing proportions at each income quartile but the response was greatest at the top quartile (Ellwood and Kane 2000; See Table 1). During this period, the wealthiest students displayed a bigger

² College entry rates overall have increased over time: the proportion of all individuals with some college experience increased from 16% in 1940 to 66% in 2007 (Bailey and Dynarski 2011), while the share of high school graduates with some college increased from 51% in 1970 to 67% in 1999 (Turner 2004). However, college completion rates have not kept pace—and in some cases fallen. From 1968 to 2007, the rate of bachelor's degree attainment barely increased (Bowen et al. 2009); the college graduation rate for 23 year olds slipped from 40% in 1980 to 34% in 2000 (Turner 2004). Note that there are significant changes in college participation rates by race and gender, but these trends predate the increasing returns to college.

increase in college entry rates in both absolute and proportional terms: at the top income quartile, postsecondary attendance among high school graduates jumped from 80% to 90%, while the bottom quartile moved from 57% to 60%. A comparison of the high school classes of 1979 and 1997 reveals similar results (Bailey and Dynarski 2011).

There are large differences in college entry by income level, even for students with similar test scores. For those scoring in the top tercile of academic performance, the wealthiest students were 31% more likely to attend college than the poorest students in 1992 (Ellwood and Kane 2000; Carneiro and Heckman 2003). For low achieving students, the gap in college enrollment between high-income and low-income groups has increased in absolute and relative terms from 1980 to 1992 (Turner 2004).

Degree completion

There are large gaps in degree attainment by income level, with bigger gains for higher income groups contributing to inequality. Examining college entrants in 1992, wealthy students were almost twice as likely to graduate (72%) as poor students (40%) and were nearly five times more likely to earn a bachelor's degree (52% vs. 11%) by age 26 (Bowen et al. 2009). Lower income groups often take longer to finish a degree, but expanding the window to 20 or even 30 years after college entry has a small effect on income gaps (Attewell and Lavin 2007). The college completion differences by income have grown from 1979 to 1997 (Bailey and Dynarski 2011). If we focus on bachelor's degrees, the proportion of students who enrolled in four-year colleges and earned a BA by age 26 actually *fell* for all students from 1982-1992, except for those in the top income quartile (Bowen et al. 2009).

Similar to college entry, differences in academic preparation only explain a fraction of the observed variation in college completion rates by family income. High school reading and

math test scores account for one quarter of the gap in college completion between the highest income and lowest income college entrants (Bowen et al. 2009). Students scoring in the top quartile on standardized tests are far more likely to earn a bachelor's degree if their family income is above the median (78%) than if it is below (54%) (Wyner et al. 2009).

Further, these income differences in graduation rates appear to be magnified by the type of college attended. At less selective colleges, 82% of high scoring, upper-income students complete a degree, compared to 70% of high scoring, low-income students; at non-selective colleges, the difference expands to 83% vs. 56% (Wyner et al. 2009). This last finding suggests that lower income students might be more sensitive to institutional effects like school quality, but further research is needed.

The Economic and Social Importance of a College Education

Improving college outcomes is important for individual earnings, social benefits, and macroeconomic impacts. A college degree produces a greater return on investment than the stock market, bonds, or home ownership (Greenstone and Looney 2011). In 2008, bachelor's degree holders earned nearly \$22,000 per year more than high school graduates and had 1.66 times the expected lifetime earnings (Baum et al. 2010; See Table 2). The causal effect of schooling on earnings (Card 2001; Card 1999) suggests that increased college access and completion can reduce income inequality (Goldin and Katz 2008). In addition, college-educated individuals experience greater economic mobility (Haskins and Sawhill 2009), lower unemployment rates (Alini and Lahart 2009; Leonhardt 2009), and better employment benefits, like pension plans and health insurance (Baum et al. 2010).

Postsecondary schooling also leads to beneficial social outcomes beyond higher earnings. For mothers, college attendance improves health, parenting skills, and resources invested in their

child's development (Currie and Moretti 2003; Attewell and Lavin 2007). College attendance also promotes increased civic participation among adults (Dee 2004), and reduced likelihood of receiving public assistance and engaging in risky behavior (Oreopoulos and Salvanes 2011).

Finally, increasing the college educated workforce has important macroeconomic implications for urban revitalization, national productivity, and international competitiveness. Cities will need an infusion of college-educated workers to reverse urban decline and stimulate economic growth (Merisotis 2011; Rauch 1993). The Department of Labor (2009) predicts that one-half of all new jobs will require postsecondary education, so producing more educated workers will be essential to meet demand. The U.S. once led the world in the proportion of adults with a college degree (OECD 2009); regaining that position is important for staying competitive in the global economy.

IV. Literature Review

The economic and social benefits of a college education provide additional support for policy decisions to expand college access and improve college completion, but also further complicate the puzzle. Given the important and growing advantages to having a bachelor's degree, why are relatively few students enrolling in and graduating from college? National surveys indicate that the proportion of high school students who aspire to complete a bachelor's degree is increasing over time (NCES 2010a), so reduced desire for higher education does not explain participation trends. Instead, scholars point to structural problems in higher education access or inadequate preparation of potential students.

Reasons Why College Participation Has Declined Relative to the Wage Premium

There are two main arguments that attempt to explain the discrepancy between the increasing college wage premium and the relative decline in college participation for students on

the margin: 1) market failures, including credit constraints and inadequate information, prevent students from attending college, and 2) students are behaving rationally because their individual returns to education are low.³ The evidence supports some aspects of each argument, but unexplained variation in college outcomes calls for more research.

Market failures

Many scholars and analysts argue that the reason why more students are not participating in college, despite the rising college wage premium, is that the postsecondary education market is imperfect. The market failure argument generally identifies three areas that prevent the college education system from operating efficiently: 1) cost, 2) information, and 3) undermatching.

Cost

The large financial cost of college provides a straightforward explanation for why students do not enroll at higher rates as income and credit constraints may make it unaffordable. Adjusted for inflation, college tuition has risen steadily since the 1950s, increased more than 24% in the past 10 years (NCES 2010a), and climbed sharply relative to median family income since 1980 (Goldin and Katz 2008). Student enrollment is sensitive to a sudden increase in college tuition (Kane 1999; Leslie and Brinkman 1987), while a large majority (75%) of respondents already believe college is too expensive for most Americans (Taylor et al. 2011). Programs that effectively reduce college tuition, e.g. Social Security Student Benefits and state merit scholarships, show a 4 percentage point increase in attendance for every \$1,000 of aid, although the results do not hold in all states (Dynarski 2003; 2008; 2004; Scott-Clayton 2009;

³ Similarly, college participation is not predicted to increase if the marginal student has weaker abilities than in the past. The rise in GED recipients is consistent with this view (Cameron and Heckman 2001). However, national test scores have increased over time (Bound et al. 2010; NCES 2010). Also, many qualified, low income students exist but do not enroll in selective colleges (Hill and Winston 2006; Pallais and Turner 2007), which suggests that compositional shifts do not explain gaps in college participation.

Goodman 2008). Further, the shifts toward offering loans instead of grants, and the increasing proportion of financial aid directed to students from wealthy families, create additional financial obstacles for lower income students (St. John et al. 2006; McPherson and Schapiro 2006).⁴

The inability to pay for rising college tuition is an intuitively appealing reason for low college participation, but several pieces of evidence argue against a simple explanation. Average tuition increases are driven by the most expensive private universities (Hoxby 2000), but most students attend cheaper colleges where inflation adjusted tuition growth has been modest (GAO 2007). Further, changes in sticker price do not reveal the actual tuition paid by college students. At many four-year private universities, subsidies reduce the net price below that of public institutions, while financial aid makes the net price zero or even negative at community colleges (Hoxby 2009; Winston 1999; Lynch et al. 2011; Schwartz 2007). Additionally, several private universities and state higher education systems have introduced need-based aid programs that pay full tuition for qualified low-income students (Pallais and Turner 2007). Although the research findings from state merit scholarship programs indicate that students react to changes in cost, they do not prove financial constraints (Heckman 2000). Many beneficiaries of these merit-based programs would have attended college even in the absence of scholarships (Dynarski 2008). The wide availability of student loans and the meager effects of Pell grants on enrollment provide further evidence that potential students are not credit constrained (Carneiro and Heckman 2003; Hansen 1983).

Family income likely plays an important role in college participation, especially for lower income students, but a simple inability to afford tuition at the time of college entry does not

⁴ A related argument claims that rising tuition has led to increased student employment during college, which harms academic performance (Stinebrickner and Stinebrickner 2003; Bound et al. 2010). But reducing the number of hours worked in school changes consumption patterns, not time spent studying (Keane and Wolpin 2001).

appear to be a binding constraint; family income during early childhood has a larger effect on completed schooling than income during high school (Brooks-Gunn and Duncan 1997).

Information

A second type of market failure that might limit individuals in obtaining a college education is uncertainty or a lack of information about the costs and benefits of college. Students and parents “investing in human capital through a purchase of higher education don’t know what they’re buying—and won’t and can’t know what they have bought until it is far too late to do anything about it” (Winston 1999, 15). This absence of knowledge about the individual’s net return to college is likely most true for students on the margin of attending. If either parents or students are unaware of the higher earnings associated with a college education or overestimate the costs of going to college, then we would expect lower rates of college entry and completion. For example, high-achieving low-income students and parents in Virginia are more likely to make inaccurate estimations of the net cost of college than high income families (Avery and Turner 2009).⁵ But a comparison of students in low-income Boston public schools and wealthy suburban schools actually finds that these groups hold similar beliefs about tuition costs, financial aid, and the college wage premium (Avery and Kane 2004).

Similarly, high school students may possess inadequate information about college admissions requirements and the steps involved in applying to postsecondary institutions. Low income students obtain information about college from a relatively small number of sources compared to high income students (Horn et al. 2003; Grodsky and Jones 2007). Further, students from disadvantaged backgrounds have limited access to computers and college guidebooks to search for postsecondary institutions (McDonough 1997). Parents from low-income

⁵ Simplifying the financial aid process and providing eligibility information can increase aid applications, college enrollment, and receipt of financial assistance (Dynarski and Scott-Clayton 2006; Bettinger et al. 2009).

backgrounds are less knowledgeable about college and financial aid than high-income parents, which affects their children's access to this information (Terenzini et al. 2001). Students also lack information about how to successfully navigate the college admissions process due to limited access to social capital or weaker networks (Deil-Amen and Turley 2007; Avery and Turner 2009). High school guidance counselors play a primary role in providing college information to students, especially low-income students (McDonough 2005; Perna et al. 2008; Plank and Jordan 2001; Avery 2010). However, little research has examined what types of college information counselors provide and how students use this information.

Undermatching

High tuition and lack of information can combine to create a third constraint on college participation: undermatching (Bowen et al. 2009). Students who are academically qualified to attend college or more selective colleges often do not attend at all or attend less selective ones, which indicates that the higher education market is operating inefficiently (Dillon and Smith 2009). Controlling for test scores, grade point average (GPA), and family background, low-income students are less likely to apply to selective colleges than wealthier peers (Griffith and Rothstein 2009). Over 60% of Chicago public school students enroll in institutions that are less selective than the colleges to which they likely would have been accepted, based on their academic performance (Roderick et al. 2008). Even students in advanced high school programs engage in undermatching: one-third either attend nonselective four-year colleges or two-year colleges, or do not enroll in any college (Roderick et al. 2009). In North Carolina, more than 40% of highly qualified students, i.e. those with a combination of high school GPA and SAT scores that result in admission for 9 out of 10 applicants, do not attend the most selective state universities (Bowen et al. 2009).

Undermatching has important financial consequences as attending more selective colleges leads to increased future earnings (Brewer et al. 1999; Monks 2000; Hoekstra 2009). Other work finds that low-income and minority students benefit most from attending extremely selective, mostly private universities (Dale and Krueger 2011; 2002).

Undermatching is a serious problem because less selective colleges have low graduation rates, but we do not know if these rates are due to the institutions or entering students. The average graduation rate at nearly two-thirds of all bachelor's degree granting institutions is below 50%; the majority of undergraduates attend these colleges and universities (Hess et al. 2009). More than 10% of students attend colleges and universities that graduate less than one in three students (Schneider 2008).

Although much work has examined the effects of attending community colleges on degree completion (e.g. Rouse 1995; 1998; Leigh and Gill 2003; Doyle 2009; Reynolds 2009; Stephan et al. 2009), little research has explored the impact of college quality on graduation rates in the widely varying four-year sector. College quality, as measured by admissions and spending, is associated with higher graduation rates (Bowen and Bok 1998; Alon and Tienda 2005), but these studies focused on the most selective private institutions, where low-income students comprise as little as 10% of enrollees (Hill and Winston 2006). Low ability students appear more likely to graduate if they attend low quality colleges, while high ability students have better chances at high quality colleges (Light and Strayer 2000). OLS estimates and a comparison of students matched on test scores, high school grades, and family backgrounds reveal that those who attend highly selective colleges are more likely to graduate than those attending less selective colleges (Long 2008; Bowen et al. 2009). However, the differences in college choice and outcomes could be due to unobserved student variables. Ideally, we would

measure the effect of selectivity by conducting a controlled experiment that randomly assigns qualified students to more selective and less selective colleges. In the absence of this experiment, researchers must find exogenous variation in the selectivity of colleges attended to account for selection bias.

Rational decisions

As opposed to market failures preventing more people from attending college, individuals might be behaving rationally in choosing not to pursue postsecondary education because they experience lower returns to schooling. Even though bachelor's degree holders earn more money *on average* than those with only a high school diploma, this may not hold true for a given individual, in which case it might make sense that some students decide not to attend college. For example, about 20% of men and 14% of women with a college degree earn less than the average high school graduate (Schmitt and Boushey 2010). The lower returns could be due to the type of institution attended or individual ability.

Contrary to the rational choice argument, research using quasi-experimental methods reveals that students on the margin of attending actually experience higher returns to college than those students who would be likely to attend based on background characteristics. Given that higher ability students are more likely to pursue college, we would expect ordinary least squares (OLS) estimates of the returns to college to be upward biased. However, instrumental variables (IV) estimates of the impact of college attendance on earnings are higher than OLS estimates, which is consistent with marginal students experiencing higher returns to schooling (Card 1993; Card 1999). This finding holds for different instruments for college attendance, including the presence of a college in a metropolitan area and the distance from an individual's high school to the nearest college (Card 1993; Rouse 1995). Similarly, propensity score matching indicates that

those least likely to attend college benefit more from attending in terms of higher earnings (Brand and Xie 2010).⁶

Students on the margin who do not attend or complete college could be making rational choices if the costs of education (including tuition, psychic costs, and opportunity costs) exceed the benefits based on their own abilities and job prospects. For certain individuals, this outcome is predicted by human capital theory, even in the face of a rising college wage premium. For example, if students with low abilities are not admitted to a quality college or enroll but do not graduate, then these students might be better off avoiding college altogether. Indeed, some students might enter college to test if they are “college material” (Manski 1989). Controlling for ability, as measured by scores on the Armed Forces Qualification Test (AFQT), reduces the observed gaps in college attendance by income and race, and in some cases reveals that low-income and minority students are more likely to attend college than wealthy or white students of similar ability levels (Carneiro and Heckman 2003). But these results do not hold for other measures of ability.

Differences in academic achievement can explain much of the income gaps in college attendance, but do not eliminate these gaps. Based on national level survey data, controlling for grades and test scores in high school reduces the four-year college enrollment gap by nearly 60%, and the overall postsecondary enrollment gap by more than 40%, but students from the highest income quartile are still more likely to go to college by 15 percentage points (Ellwood and Kane 2000). Adding parental education further reduces the gap (to 9 percentage points) but

⁶ Further, students benefit from attending two-year colleges, despite open admissions, limited resources, and low graduation rates at these institutions. A worker with an associate’s degree earns 22-35% more than someone with only a high school diploma, while students who enroll in two-year colleges but do not finish earn 9-13% more than observationally similar high school graduates (Grubb 2002; Leigh and Gill 2003; Kane and Rouse 1999; 1995). A year’s worth of credits at a community college leads to a 5-11% increase in annual earnings, which is about the same value as a year’s worth of credits at a four-year college (Marcotte et al. 2005; Kane and Rouse 1995; Grubb 1995).

does not erase it (Ellwood and Kane 2000). The intended enrollment gap between low income and high income students in Massachusetts remains at 8%, even controlling for test scores and school district quality (Goodman 2010). Similar gaps remain in college graduation rates. Based on a sample of flagship universities, adjusting for high school grades and other background characteristics has a small effect on graduation rate differences between students of high, medium, and low socioeconomic status (Bowen et al. 2009).

Summary

Both the market failure argument and the rational choice argument only partially explain why so few students on the margin are enrolling in and graduating from college despite the increasing returns to obtaining a college degree. Despite rising tuition costs, both in absolute terms and relative to family income, students from low-income families attend college in greater proportions than they did in the past, which weakens the case for market failures. Students who enter college with weak academic preparation nonetheless experience successful outcomes and earnings benefits, which argues against rational choices based on low returns. The variation in college participation for students on the margin of attending requires an alternative explanation.

Motivational Qualities Predict Outcomes Independent of Income and Test Scores

Financial constraints and weak academic preparation might lead students to avoid college or to attend less selective institutions despite possessing motivational qualities that are important for educational and labor market success (Sedlacek 2005; 2004). These qualities include self-efficacy, conscientiousness, and persistence. While previous work in economics focused on the importance of cognitive ability for labor market outcomes (e.g. Murnane et al. 1995; Johnson and Neal 1998), there is increasing interest in ‘soft’ skills (Bowles et al. 2001; Borghans et al. 2008; Almlund et al. 2011). Employers prize social skills, like attitude and communication,

more than industry test scores and academic performance when making hiring decisions (Shapiro and Iannozzi 1999; Holzer 1996; U.S. Census 1995). Further, changes in the labor market have generated increased demand for workers who are able to analyze information and solve problems but also work in teams and communicate effectively (Murnane and Levy 1996). The economics literature refers to motivational qualities as non-cognitive skills, but I follow Borghans et al. (2008) in avoiding this term because it inaccurately implies that there is no cognitive component to these qualities. Much work on motivational qualities comes from achievement motivation theory and research.

Achievement motivation theory

The achievement motivation literature theorizes that achievement behaviors are influenced by the values attached to success and the likelihood of success (Atkinson 1964; Wigfield and Eccles 2000); the causal role of one's own actions in generating outcomes (Rotter 1990); and attributions of stability and control over one's actions (Weiner 1992). Success is valued because people are inherently motivated to maintain a positive sense of self-worth (Covington 1984) and competence (Deci and Ryan 1985). Individuals who feel they possess the ability and can successfully produce the necessary actions to achieve their goals, as opposed to feeling incapable, are described as having high levels of self-efficacy (Bandura 1997).

Recent research posits that achievement behaviors are firmly rooted in individual beliefs about ability (Stipek 2002). A goal theory proposes that differences in academic performance can be attributed to whether students believe ability is fixed (entity) or malleable (incremental). People who hold an entity mindset believe that an individual's ability level, like IQ, is innate, fixed, and stable over time, and that some people are naturally endowed with higher levels of ability than others (Dweck 2000; Dweck and Elliot 1983). Students who feel that ability is fixed

are more susceptible to maladaptive behaviors like learned helplessness. In contrast, individuals who believe that ability can be developed maintain an incremental mindset that “intelligence consists of an ever-expanding repertoire of skills and knowledge ... that is increased through one’s own instrumental behavior” (Dweck and Bempechat 1983, 244). Students who feel that ability can be developed adhere to beliefs that are more adaptive for learning, e.g. recognizing the value of effort and learning from mistakes (Dweck 2008). The entity and incremental theories suggest that student beliefs about the nature of abilities, as opposed to their actual level of academic ability, can influence educational persistence.⁷

Predicting outcomes

A growing body of work reveals that personality traits, motivational qualities, and other “soft skills” predict earnings and social outcomes. Motivational qualities, e.g. school misbehavior as reported by teachers, are consistently strong predictors of income independent of test scores, years of education, and parental socioeconomic status (Segal 2011; Bowles et al. 2001; Jencks et al. 1979). Additionally, motivational qualities and personality traits are just as important as cognitive skills in predicting earnings (Lindqvist and Vestman 2011; Filer 1981; Mueller and Plug 2006). Further, higher levels of specific motivational qualities, like industriousness and perseverance, are not only associated with higher wages, they are more important than cognitive skills in predicting future income (Jencks et al. 1979; Heckman et al. 2006).

Motivational qualities also display durable effects on future income. Students exhibiting higher levels of leadership and self-esteem in high school show higher earnings up to 10 years

⁷ Behavioral and motivational skills are often formed in school, where students are socialized for academic and labor market success (Dreeben 1967; Parsons 1959; Bowles and Gintis 1976; Rosen et al. 2010). Human capital, cultural capital, and social capital theories all suggest causal processes of how individuals obtain different levels of motivational qualities in school (Farkas 2003; Bowles and Gintis 2002).

later (Rosenbaum 2001; Murnane et al. 2001). Programs that influence behavioral traits as early as kindergarten appear to have long-lasting behavioral effects and a huge impact on earnings more than 20 years later (Chetty et al. 2010). Motivation levels measured at age 21-29 successfully predict earnings 15-25 years later (Dunifon and Duncan 1998).

Recent work shows that motivational qualities and personality traits are also associated with a variety of important social outcomes. Self-control measured in children successfully predicts a range of outcomes by age 32, including physical health, drug use, and criminal convictions (Moffitt et al. 2011). This relationship holds even when controlling for social class and IQ. A review of the psychology literature reveals that different combinations of the Big Five personality traits are associated with rates of mortality and divorce (Roberts et al. 2007). Further, the effects of personality are similar in magnitude to the effects of cognitive ability and socioeconomic status. Early intervention programs (e.g. Tennessee STAR, Perry Pre-school, and Head Start) do not have long-lasting effects on achievement test scores, but do result in college test-taking, increased employment, and decreased risky behavior as an adult (Krueger and Whitmore 2001; Heckman 2000; Deming 2009). Some economists have reasoned that because these interventions show little impact on cognitive ability, they must be altering non-cognitive skills, but more research is needed to identify what these skills are.

Empirical research finds that motivational qualities predict educational outcomes in adolescents and young adults. Self-discipline in 8th graders explains twice as much variation as IQ in a series of measures, including final grades, hours spent on homework, and school attendance, even controlling for prior achievement and ability (Duckworth and Seligman 2005). Teacher evaluations of student behavior in high school are strongly associated with eventual educational attainment (Lleras 2008). Self-reported levels of academic discipline are

incrementally predictive of grade point average and retention in college students (Robbins et al. 2006). The strong predictive power of motivational qualities suggests these qualities may also predict college outcomes like graduation, independent of income and achievement.

V. Proposal Summary

A slowdown in the rate of growth of the supply of college-educated workers has pushed up the college wage premium and contributed to growing U.S. income inequality in the past 30 years. Standard economic theories predict increased college enrollment and completion in response to the increasing returns to a college degree. However, rising college attendance has been skewed toward higher income groups while college graduation rates have increased slightly. Market failures in higher education and rational choices based on low expected returns both provide plausible explanations for why marginal students are not enrolling in and graduating from college in greater numbers despite the increasing returns to obtaining a college degree. To determine how public policy can effectively improve college participation, we need to know if students have accurate information about college preparation and the application process; how college quality affects degree completion; and if motivational qualities like persistence predict college outcomes.

Research Questions

1) *Do motivational qualities, like persistence and self-esteem, predict success in college and the labor market, independent of test scores?*

Students might possess the non-academic skills necessary to succeed in college and in the labor market, but low test scores lead them to weaker institutions or to avoid college altogether. Further, these skills could be more important to future success for those students on the margin of pursuing higher education. Previous work has examined earnings but has overlooked college

completion. If motivational qualities are strongly predictive of degree completion, then admissions policies could be altered to better identify potentially successful students despite low test scores. I conduct multivariate regression analysis to determine if motivational qualities measured in 8th grade predict college completion, controlling for family income and standardized test scores.

2) Do lower income students possess adequate information about college preparation and the application process?

Students might possess limited or inaccurate information about college preparation requirements and the steps they must take to apply for admission. Prior work finds that high school counselors play a primary role in providing this information, especially for low income students, but few studies have examined the types of information that counselors offer and how students process this information. Improved information about the college admissions process could encourage more students to apply to and enroll in postsecondary institutions. I observe guidance sessions and conduct interviews with high school guidance counselors, college awareness advisors, and students to understand what college information is transmitted and how it is interpreted.

3) Does attending less selective colleges decrease the likelihood of earning a bachelor's degree?

Qualified lower income students who pursue postsecondary education often enroll in less selective colleges, which have fewer resources to support student success. However, existing work has not determined if the lower graduation rates observed at these colleges are a function of entering student ability or institutional factors. If college selectivity is the reason, then encouraging students to attend more selective colleges could have a big payoff in increasing the population of degree holders. To isolate the causal effect of attending a less selective college on

academic performance, I use quasi-experimental methods to compare similar students exposed to different levels of college selectivity.

VI. Significance of the Study

This dissertation helps explain the puzzle of low college participation by expanding our knowledge about barriers to higher education for lower income students. My research contributes new evidence on the role of expectations, college selectivity, and motivational qualities in influencing student outcomes. By investigating how geographic variation in college quality affects lower income students, my work links to the literature on spatial inequality and the geography of opportunity (Lobao et al. 2007; Galster and Killen 1995; Briggs 2005).

The findings have important policy implications for improving college participation through increased information, better matching, and alternative admissions practices. Evidence that admissions misperceptions limit college choices will suggest expanding college advising programs to raise expectations. Similarly, findings that less selective colleges reduce the chances of graduation will indicate that improved student-college matches must be included in any policy to increase college enrollment. Results showing that motivational qualities are strong predictors of college success will argue for including these measures in the college admissions process.⁸ Further, the results have implications for revitalizing communities as workers with multidimensional skills are important for urban growth and productivity; the agglomeration of these workers in cities contributes to further skill development (Bacolod et al. 2010). Ultimately, the results will help improve public policy decisions to expand college access, raise the level of human capital, and promote economic development.

⁸ In each of these cases, traditional policy responses, i.e. a) increased financial aid to alleviate credit constraints, and b) increased spending on secondary schools to raise student ability, would not improve college participation.

Tables

Table 1 - Proportion of Students Enrolled in Postsecondary Education Within 20 Months of High School Graduation

High School Classes of 1980 and 1982

	None	Vocational	Two-Year	Four-Year
Lowest Income Quartile	43%	12%	16%	29%
Second Income Quartile	37%	11%	19%	33%
Third Income Quartile	28%	10%	22%	39%
Highest Income Quartile	19%	6%	19%	55%

High School Class of 1992

	None	Vocational	Two-Year	Four-Year
Lowest Income Quartile	40%	10%	22%	28%
Second Income Quartile	30%	7%	25%	38%
Third Income Quartile	20%	6%	25%	48%
Highest Income Quartile	10%	5%	19%	66%

Source: Ellwood and Kane (2000) based on NCES data.

Table 2 - Median Earnings in 2008 of Full-Time Workers Ages 25 and Older, and Expected Lifetime Earnings Relative to High School Graduates, by Education Level

	Median Earnings	Lifetime Earnings Ratio
Did not graduate high school	\$24,300	0.71
High school graduate	\$33,800	1.00
Associate's degree	\$42,000	1.24
Bachelor's degree	\$55,700	1.66
Master's degree	\$67,300	1.97

Source: Baum et al. (2010) based on U.S. Census Bureau data.

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The Old College Try: Estimating the Impact of Motivational Qualities on College Degree Completion

Abstract

Scholars and college admissions officers rely on conventional measures of cognitive ability, like high school grades and standardized test scores, to predict student performance in postsecondary education. However, this traditional approach overlooks important motivational qualities that determine success in higher education and beyond. Social cognition theory holds that academic attitudes and achievement-oriented beliefs influence early scholastic achievement. Yet few studies have explored the relationship between these non-cognitive skills and college completion. Further, prior work has produced conflicting results and raises questions of reverse causality. My research addresses these gaps by determining if motivational qualities developed by 8th grade, i.e. causally prior to postsecondary enrollment, predict college graduation. Using National Education Longitudinal Study data, I find that student locus of control, test effort, and internal motivation have a positive effect on the probability of bachelor's degree completion, independent of grades, family background, and demographic characteristics. This research contributes to the literature by revealing that motivation qualities displayed in adolescence consistently predict future degree attainment and that the positive effect is concentrated among disadvantaged students. In addition, I create new measures of motivational qualities that can be used in future studies. The findings suggest that colleges can both improve their graduation rates and increase student diversity by attaching more weight to motivation qualities in the admissions process.

The Old College Try: Estimating the Impact of Motivational Qualities on College Degree Completion

I. Introduction

College officials and education researchers use traditional measures of cognitive ability, like high school grades and standardized test scores, to predict student outcomes. College admissions officers emphasize the importance of prior academic performance in evaluating an applicant's potential for success in college (Carnevale and Rose 2004). Researchers also use cognitive ability to explain gaps in higher education attainment between subpopulations. For example, students from low income backgrounds have lower grades and standardized test scores than wealthy students. Indeed, differences in cognitive ability and high school achievement help explain why low income students are far less likely to enroll in college than high income students (Carneiro and Heckman 2003; Ellwood and Kane 2000).

However, conventional measures of academic performance may not accurately reflect student potential for higher education. For example, admissions officers rely on SAT and ACT scores, but these measures are less useful than high school grade point average in predicting academic achievement in college (Camara and Echternacht 2000; Rothstein 2004; Geiser and Santelices 2007). Further, low test scores may mask individual traits that are important for success in college and beyond (Sedlacek 2005; 2004). According to social cognition theory, beliefs about one's own capacity for success reflect individual qualities that influence behavior (Bandura 1986; Stipek 2002). These beliefs include internal locus of control, positive self-concept, and adaptive achievement beliefs, such as an effort orientation.⁹ For low income students in particular, high levels of motivational qualities may compensate for resource

⁹ Locus of control refers to how an individual perceives the causal relationship between her actions and outcomes. Self-concept describes how people perceive their own ability and success. For further discussion, see Section II. B. below.

constraints they experience in their home and school environments. As a result, some scholars have attempted to measure the relationship between an individual's motivational qualities and life outcomes.

Empirical research shows that motivational qualities are important for employment, earnings, and school performance, but the results for college outcomes are inconsistent. Employer surveys and interviews reveal that attitude, disposition, and the ability to work well with others are valued more than school credentials in hiring decisions (Shapiro and Iannozzi 1999; Holzer 1996; Murnane and Levy 1996). Further, qualities like internal locus of control, good behavior, and high self-concept show a positive relationship with future wages and occupational attainment (Goldsmith et al. 1997; Segal forthcoming; Andrisani 1977). In the education realm, internal locus of control is associated with higher test scores across a range of studies in the motivation literature (Findley and Cooper 1983; Kalechstein and Nowicki 1997). But prior research has produced conflicting results about the impact of behavioral qualities on college outcomes, as various studies find positive, negative, or insignificant effects (e.g. Coleman and DeLeire 2003; Cebi 2007).

My research determines if student motivational qualities developed by adolescence predict the chances of obtaining a college degree, controlling for other factors like academic performance, family background, and demographic characteristics. Using logistic regression analysis, I examine several motivational qualities, including locus of control, self-concept, and test effort. In addition, I determine if motivational qualities have a bigger effect on the probability of college completion for low socioeconomic status (SES) students compared to high SES students. To assess the consistency and robustness of the relationship, I use several measures of motivational qualities: 1) answers to individual survey questions about motivation,

2) composite psychological constructs of motivational qualities based on sets of survey questions, and 3) residual measures that capture unobserved psychological characteristics. To conduct the analysis, I use National Education Longitudinal Study of 1988 data, which consists of a nationally representative sample of students in the U.S., so the results are generalizable to the population.

I find that student motivational qualities developed by 8th grade, like locus of control and test effort, have a strong positive effect on the likelihood of earning a bachelor's degree up to 12 years later. This relationship is independent of other factors that affect educational attainment, including grades, family background, and demographic characteristics. Further, the effect is consistent across different estimation strategies. In addition, I find evidence that the broad, generalized expectancy of locus of control operates through the channel of domain-specific academic beliefs, which is consistent with psychology theory.

This research makes several contributions to the literature. First, I provide strong empirical evidence that motivational qualities exhibited at a young age improve the probability of college degree completion. This relationship is robust to different measures of motivational qualities. Second, I show that the positive effect of internal locus of control is concentrated among low SES students, i.e. these students benefit the most from strong motivation qualities. Third, I identify specific beliefs about the value of school performance that underlie the general attitude described by locus of control. Fourth, I create new measures of students' motivational qualities that can be employed in future research.

The results suggest that many low income students have a stronger chance of succeeding in higher education than would be predicted solely by conventional measures, like prior academic performance. Current public policy efforts to increase college degree attainment could

be advanced by encouraging students with high motivational qualities to pursue postsecondary education, despite low grades or test scores. An excessive reliance on previous school achievement may lead colleges to overlook promising students, especially those from low income backgrounds. College admissions officers could improve graduation rates and increase socioeconomic diversity by attaching more weight to student motivational qualities in evaluating applicants' potential for success. Lastly, a small but growing body of research in psychology suggests that modest interventions at young ages can alter an individual's achievement-oriented behavior. Building on this work, college participation programs should expand their scope to help raise students' motivational qualities, instead of narrowly focusing on test preparation and financial aid.

The rest of this chapter proceeds as follows. In the next section, I present psychology theory on the importance of motivational qualities in actions and decision-making. I also identify and elaborate on specific examples of motivational qualities, like locus of control and self-concept. Then, I describe previous research that generally finds a positive relationship between motivational qualities and school performance, but conflicting results for higher education outcomes. The following section describes the longitudinal data, motivational quality measures, and regression models used in my analysis. Then, I present my findings and discuss the implications for college admissions and college preparation programs. The final section concludes.

II. Theory and Empirical Evidence on Motivational Qualities

Achievement Motivation Theory

Social cognition

The major theories in psychology indicate that motivational qualities play a prominent role in shaping individual outcomes, especially in educational settings. Social cognition theory holds that a person's beliefs and thoughts mediate the effects of the environment on her behavior (Bandura 1986; 1977). "Expectations, beliefs, self-perceptions, goals and intentions give shape and direction to behavior. What people think, believe, and feel, affects how they behave" (Bandura 1989, 3). Attitudes and beliefs about achievement reflect how people interpret their prior achievement experiences. In particular, an individual's perceptions of her ability and the causes of outcomes can influence actions and affective processes, like task performance and persistence (Stipek 2002). Achievement cognitions and learning beliefs influence emotions, which in turn affect an individual's level of engagement in academic tasks. For example, a student who doubts her math capability may experience anxiety during a math test, which lowers her test performance.

Social learning

Social learning theory seeks to explain human behavior by combining cognitive and stimulus-response theories. Social learning theory posits that individual behavior depends on subjective beliefs about the nature and causes of rewards (Rotter 1966). Rewards help to reinforce some behaviors while punishments serve to eliminate others. Individuals may perceive rewards and other outcomes to be under their control or outside of it. Perceptions of control can affect achievement behaviors, including effort and persistence (Stipek 2002). For example, a student who feels that external rewards like teacher approval are caused by the student's actions will be more likely to engage in school work that leads to approval (assuming they value it), compared to students who believe teacher responses are arbitrary or pre-determined. The complete theory of social learning consists of four types of variables: behaviors, expectancies,

reinforcements, and psychological situations (Rotter 1975). Behavior is affected by generalized expectancies *and* by the specific value attached to rewards or reinforcements.

Expectancy value

Expectancy value theory suggests that achievement-oriented behaviors are determined by expectations and the value attached to specific behaviors (Atkinson 1964). Expectancies are measured by an individual's belief about how well she will perform on a future task (Wigfield and Eccles 2000). The perceived probability of success and the importance of success will affect an individual's propensity to pursue or avoid tasks (Stipek 2002). Expectancy values directly affect achievement choices; they also influence performance, effort, and persistence (Wigfield and Eccles 2000). Expectancies and values are subjectively determined by the individual; they need not correspond with external evaluations. For example, a student who believes she has little chance of being admitted to college may avoid completing and submitting her application, regardless of her grades and test scores.

Implications for college completion

In the higher education context, psychological theory posits that motivational qualities can affect degree completion through several channels. Assuming they value and desire a degree, students who strongly believe that they have control over their educational trajectory will be more likely to engage in supportive academic behaviors and obtain a degree than other people, all else equal, because they will perceive a causal relationship between their actions and educational outcomes. Similarly, students who believe that completing a degree is important and that they have a high probability of accomplishing this goal will be more likely to take the necessary steps (e.g. take required classes, complete course assignments, reenroll in subsequent years, etc.) to reach graduation. Motivational qualities can also have an indirect effect on degree

completion by increasing achievement orientation and academic effort in classes, which can improve grades and make college graduation more likely.

Examples of Motivational Qualities

Theoretical and empirical work in psychology has identified several motivational qualities that exhibit strong, consistent relationships with individual actions. Generally, these qualities describe personal beliefs or attitudes that influence decisions and behaviors. Motivational qualities are malleable but they typically stabilize by age 12. In the economics literature, researchers have focused on a subset of well-defined qualities, in particular locus of control and self-concept, which are associated with important education and labor market outcomes.

Locus of control

Locus of control is a widely used measure in psychology that describes how an individual perceives the causal relationship between her actions and future outcomes. Individuals hold beliefs about the degree to which their behaviors influence the things that happen to them, i.e. how much control they have over their lives (Rotter 1966; Lefcourt 1976). These beliefs fall into two categories: external control and internal control.

“When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an individual, we have labeled this a belief in *external control*. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, we have termed this belief in *internal control*” (Rotter 1966, 1).¹⁰

¹⁰ Some studies in the economics literature (e.g. Baron and Cobb-Clark 2010; Coleman and DeLeire 2003) blur the distinction between the separate psychological constructs of locus of control and self-efficacy. Locus of control refers to the degree to which an individual believes outcomes are due to her actions or to luck. Self-efficacy

Locus of control is a generalized belief, i.e. individuals tend toward internality or externality, but there can be some variation across different domains of life (e.g. work, school, home, etc). As a result, the locus construct typically has low predictive ability but it can apply to a broad range of situations. Locus of control is formed during childhood and typically stabilizes during adolescence (Stipek 2002).

In psychological testing and surveys, locus of control is measured by an individual's response to statements like: a) Many of the unhappy things in people's lives are partly due to bad luck, b) People's misfortunes result from the mistakes they make, c) I have often found that what is going to happen will happen, d) Trusting to fate has never turned out as well for me as making a decision to take a definite course of action, and e) Becoming a success is a matter of hard work; luck has little or nothing to do with it.

Self-concept

Self-concept is broadly defined to describe the ways that people perceive themselves (Rosenberg 1979). This psychological construct refers to individuals' perceptions about their own ability, success, and position, i.e. it has many specific components. In general, people who hold themselves in high regard or feel proud of their accomplishments are considered to have a high self-concept. In contrast, those who are dissatisfied with themselves or feel they do not compare well with others have a low self-concept. Theoretical and empirical work in psychology suggests that self-concept is affected by individual experience, environmental reinforcements, and attributions for one's own behavior (Shavelson et al. 1976).

describes an individual's belief in her capability to achieve a goal. Note that these are distinct concepts. For example, a person could perceive a strong causal connection between her actions and life outcomes (i.e. internal locus of control) but feel these outcomes result from her ineffectiveness in accomplishing what she sets out to do (i.e. low self-efficacy).

The psychology literature measures self-concept by an individual's response to statements like: a) I feel I have a number of good qualities, b) On the whole, I am satisfied with myself, c) All in all, I am inclined to think I am a failure, d) I take a positive attitude toward myself, and e) I wish I could have more respect for myself. The global, multi-dimensional nature of the construct can make it difficult to identify the boundaries of its effects. The broad definition limits how well researchers can accurately attribute behaviors to differences in self-concept.

A related idea is self-esteem, which refers to the extent to which people value or approve of themselves. Self-esteem describes beliefs about one's worth as a person; one's level of self-esteem depends on perceived skill or competence in fields that are valued by the individual or perceived as important (Harter 2001). Self-esteem is often thought of as an evaluative aspect of self perception, as opposed to the more descriptive nature of self-concept. Recent literature argues that self-esteem should be understood as a global component of self-concept (Marsh and O'Hara 2008).

Effect of Motivational Qualities on Education

Elementary and secondary school performance

Several studies have noted a strong association between motivational qualities and academic performance at the elementary and secondary school levels. Based on a survey of 600,000 students attending a national sample of public schools in the 1st, 3rd, 6th, 9th, and 12th grades, researchers found that locus of control had a stronger impact on standardized test scores than school quality or many demographic factors (Coleman et al. 1966). However, many scholars (e.g. Bowles and Levin 1968; Cain and Watts 1970) have questioned how these results

should be properly interpreted due to methodological concerns about stepwise regression estimation strategies.

A review of nearly 100 psychology studies finds that internal locus of control in school-age students is associated with higher levels of academic achievement, as measured by standardized test scores and intelligence tests (Findley and Cooper 1983). A follow up review of studies published from 1983-1994 also found that locus of control has a positive relationship with academic achievement (Kalechstein and Nowicki 1997). The strength of the relationship between locus of control and academic achievement is greater for adolescents than for children, which is consistent with psychological theory about motivational qualities stabilizing at later ages. Academic self-concept also shows a positive relationship with scholastic performance, independent of prior performance (see Marsh and O'Hara 2008, and the references therein).

However, these studies use simultaneous measures of motivational qualities and academic achievement, so the direction of causality is unclear. On the one hand, internal locus of control may cause a student to feel her studying behavior affects her grades, which results in improved academic performance. On the other hand, better grades may cause a student to feel she has more control over scholastic outcomes. In addition, the psychology studies are based on relatively small samples (average number of subjects per study = 156), so the generalizability of the results is limited. Despite these concerns, the observed relationship between motivational qualities and school achievement has led researchers to examine the impact on later educational outcomes.

College attendance

Previous research yields mixed results about the effects of motivational qualities on the probability of pursuing higher education. Based on National Educational Longitudinal Study

(NELS) data, 8th grade non-cognitive skills are strongly associated with college enrollment, even controlling for high school academic performance (Jacob 2002). These skills are measured by disciplinary actions, grade retention, school grades, and time spent on homework as proxies for effort. The combination of non-cognitive skills and college wage premiums explain nearly all of the gender gap in postsecondary education attendance.

Other research using NELS data finds that locus of control measured in the 8th grade has a positive, statistically significant relationship with the probability of attending a four-year college, controlling for race, ethnicity, gender, region, and whether the student lived in an urban or rural neighborhood (Coleman and DeLeire 2003). A one standard deviation increase in locus of control is associated with an 8.3 percentage point increase in the likelihood of enrolling in a four-year college. When controls for academic achievement (standardized test scores and grade point average) and parental education are added, the coefficient on locus of control is one-tenth as large (Coleman and DeLeire 2003), which suggests multicollinearity and raises questions of causality. If additional controls for family structure are included in the model, the effect of locus of control on four-year college attendance is no longer statistically significant. This study exclusively relied on locus of control to measure generalized expectancy, which ignores the specific achievement values that form a key component of social learning theory.

Research using a different dataset finds that locus of control has a weak relationship with postsecondary participation. Based on National Longitudinal Survey of Youth data on 10th and 11th graders in 1979, internal locus of control has a marginally statistically significant positive association ($p < 0.10$) with the probability of attending college, controlling for cognitive ability as measured by Armed Forces Qualification Test scores (Cebi 2007). Overall, previous studies

suggest that high motivational qualities lead to enrollment in postsecondary education but the relationship is sensitive to modeling assumptions.

Educational attainment

Recent work shows a positive relationship between behaviors in school and higher education outcomes. Based on NELS data, students attain higher levels of education if they exhibit higher levels of certain non-cognitive behaviors (Lleras 2008). These behavior measures are based on teacher evaluations of how frequently a student completes homework on time ($p < 0.001$), works hard for good grades ($p < 0.001$), and shows up for class on time ($p < 0.05$), which are used as proxies for work habits/conscientiousness. Teacher reports on students' level of passivity ($p < 0.05$) are considered a proxy for motivation. Student sociability, according to teacher ratings of how well the student relates to other students, does not have a statistically significant impact on educational attainment. In contrast with other research (see below), students' disruptiveness does not have a statistically significant impact on future schooling. The analytical sample is restricted to the 10th grade NELS cohort with no missing data who are primarily working and employed full-time ($n = 7,656$). A major limitation of this study is that it relies on an ordinal measure of education that treats successive increases in educational attainment the same at all levels. For example, the difference between dropping out of high school and getting a high school diploma is given the same value as the difference between earning a master's degree and completing a Ph.D. but these may not be comparable. Effects on graduate school attainment may be underestimated since the study is limited to a relatively small window (4 years) after most students would have completed college. Finally, the study does not isolate the factors affecting college degree completion.

Degree completion

Research on the factors affecting college degree completion produces inconsistent findings about the impact of motivational qualities. An early study finds locus of control does not have a statistically significant relationship with earning a college degree. However, school attendance is strongly associated with bachelor's degree completion, controlling for race, gender, SES, and standardized test scores (Trusty 2004). Attendance is measured by how often students were late for school, skipped classes, or cut school. This result suggests that qualities associated with work ethic are important for degree completion. But this study uses school attendance during 12th grade, when many students have already decided to attend postsecondary education. In other words, 12th grade attendance could be endogenous because it may simply capture college commitment. Further, the generalizability of these findings is limited because the study was restricted to the subset of NELS participants who provided high school transcripts ($n=5,257$).

Other research finds that non-cognitive abilities have a strong effect on bachelor's degree completion, controlling for SES, grades, and standardized test scores, but the effects are in opposite directions (Rumberger 2010). The first measure used is 8th grade locus of control, which has a statistically significant effect ($p<0.05$) on the chances of earning a college degree. Surprisingly, the relationship between locus of control and college completion is negative: a one standard deviation increase in locus of control (more internal control) is associated with a 5% *decrease* in the odds of finishing a four-year degree. The second non-cognitive ability is educational expectations, which are measured by responses about the highest level of education that 8th grade students expect to complete; these expectations have a strong positive effect ($p<0.01$) on the probability of obtaining a college degree. However, there is a large gap in the survey sample between the proportion of 8th grade students who expect to complete college

(66%) and the proportion that actually do complete college (29%), so this variable may simply capture school environment and parents' educational expectations for their children. In other words, students' educational expectations may not be informative about their future outlook beyond what we can predict based on family background. The analytical sample ($n=8,901$) excludes respondents who were attending school during the fourth follow up survey in 2000, so the findings may overestimate the effects of motivational qualities. Finally, the study does not indicate if it used NELS survey weights in the quantitative analysis, which are crucial for proper interpretation and generalizability of the results.

Classroom behavior in secondary school is a strong predictor of success in postsecondary education. Misbehavior in the 8th grade has a negative, statistically significant effect on the chances of obtaining an associate's degree or higher, controlling for test scores (Segal forthcoming). Misbehavior is defined as students being tardy, absent, disruptive, inattentive, or not completing homework. Student misbehavior is gathered from the reports of two teachers, which improves the validity of the measure. Based on the subsample of male NELS respondents with two teacher evaluations ($n=3,852$), a one standard deviation increase in misbehavior is associated with an 8.6% decrease in the probability of completing a college degree, which is comparable in size to the effect of test scores. Further, boys who misbehave receive less benefit from high test scores than do boys who behave well. Other work using NELS and NLSY finds that school suspension has a negative, statistically significant impact on college attendance and completion (Bertrand and Pan 2011). These results provide further evidence that adolescent behaviors predict college degree completion.

Theoretical and empirical work in both psychology and economics provides evidence that connects misbehavior with locus of control. Misbehavior is associated with a present

orientation, as opposed to a future orientation. Individuals tend to discount the future much more when they make tradeoffs involving the present, in what is known as quasi-hyperbolic discounting (DellaVigna 2009). Delay of gratification and impulse control are reflected in actions based on discounting, as shown in a series of psychology experiments (e.g. Mischel and Mischel 1983). Individuals with internal locus of control may be more willing to delay immediate gratification and plan for the future because they feel that future outcomes depend on their own actions.

Summary

Research based on survey data finds that motivational qualities like locus of control exhibit a generally positive relationship with educational outcomes, including academic performance in secondary and postsecondary education. The empirical results and the underlying theory suggest that students' motivational qualities should also predict their chances of completing a college degree. However, little work has examined if students with higher levels of positive motivational qualities are more likely to finish college, independent of other characteristics. Previous research in this area has produced inconsistent results about the effect of motivational qualities on degree completion.

My study examines the role of motivational qualities in college outcomes by addressing the following research questions: 1) *Does locus of control predict the probability of earning a college degree, independent of academic achievement and family background?* 2) *Do other motivational qualities have a positive effect on the chances of obtaining a college degree?* 3) *Are motivational qualities more important in predicting degree completion for students whose parents have limited education, low occupational status, or low income?* Based on the results, I suggest ways for policy to increase college enrollment among low income students.

III. Data and Methodology

Data

The dataset I use for this analysis is the National Education Longitudinal Study (NELS), conducted by the National Center for Education Statistics (NCES) in the U.S. Department of Education. In the spring of 1988, NCES surveyed a nationally representative sample of 8th grade students. The base year survey included cognitive tests in math, reading, science, and a combination of history, citizenship, and geography. The survey also included questions about students' experiences in school, extracurricular activities, attitudes, future educational plans, and background characteristics. Questionnaires were also administered to one parent and two teachers for each student. Four follow-up surveys were conducted in subsequent years to obtain information on individual educational pathways. The last survey was administered in 2000, about eight years after most students pursuing higher education would have entered college. This time span provides a wide window during which students who attended college soon after high school could be reasonably expected to complete a degree.

Sample size

The base year NELS sample consists of 24,599 students in the 8th grade, based on a clustered, stratified national probability sample of 1,052 public and private schools. Of this initial sample, 12,144 students responded to the fourth follow up survey in 2000, which captures information about postsecondary education attainment. The analysis below is based on the nationally representative subsample of 10,827 students who participated in each of the surveys in 1988, 1990, 1992, 1994, and 2000. I use a larger sample than previous studies in order to avoid analytical problems due to student attrition.

Survey weights and generalizability

Any analysis of NELS data requires attention to the sampling design and use of survey weights to obtain results that are generalizable to the population. To enable reliable cross-sectional analysis, NCES freshened the survey sample each year by adding new students so that a given cohort would be representative of a particular grade. For example, students were added in 1990 to the initial set of respondents so that the cohort represented all 10th grade students in that year. The first (1990), third (1994), and fourth (2000) follow-up surveys did not retain the full sample of students who answered questions in the base year. The probability that a student was involved in follow-up surveys was not random; it was determined by several characteristics, including dropout status, racial and ethnic background, and the completeness of their earlier responses. Characteristics like dropout status predict years of schooling completed, so the NELS sampling design will influence the distribution of error terms in models of educational attainment (Grogger and Neal 2000). Consequently, models that use unweighted data can produce inconsistent estimates. (See Grogger and Neal (2000) for more discussion of sampling design issues in NELS.)

I account for the NELS sampling design in the model estimations reported below. To produce consistent estimators, I use the survey weight F4PNLWT provided in the NELS data for sample members who responded to each of the five survey waves. I use the svy command in Stata to obtain correct standard errors based on the NELS sampling design.

The use of survey weights allows researchers to generalize the results of their analysis to the U.S. population of 8th grade students attending most public or private schools in 1988. The following types of schools were excluded from the NELS sample: Bureau of Indian Affairs schools; vocational schools without direct enrollment, i.e. vocational schools that provide supplementary instruction to students enrolled on other schools; schools for the dependents of

Defense Department personnel; and special education schools for individuals with severe disabilities. In addition, the following groups of students were excluded from the NELS sample: students who were home schooled; students who had dropped out of school prior to 8th grade; students with insufficient English ability to comprehend the survey; and students with severe mental, physical, or emotional disabilities. As a result, the findings from this study do not apply to these excluded populations. These excluded groups should not substantially affect the results because most members of these groups have a low likelihood of pursuing higher education.

Dependent variable

The outcome of interest, or dependent variable, in this analysis is whether a student completes a college degree. During the fourth follow-up survey, when most participants were 26 years old, NCES asked respondents to report the highest postsecondary education degree attained as of 2000. The possible responses were: 1) no postsecondary education experience, 2) some postsecondary education experience, but no degree attained, 3) certificate or license, 4) Associate's degree, 5) Bachelor's degree, 6) Master's degree or equivalent, 7) Ph.D. or professional degree. NCES obtained transcript information from over 3,000 institutions to verify survey participants' responses about their postsecondary education experience. I code affirmative responses for an Associate's degree or higher as completing at least an Associate's degree. Similarly, I code affirmative responses for a Bachelor's degree or higher as completing at least a Bachelor's degree. Respondents who could not specify the type of degree they earned were coded as missing by NELS. To the extent that participants had obtained an Associate's or Bachelor's degree but did not identify it, i.e. underreporting in the data, the analysis will underestimate the effects of motivational qualities on degree completion.

Motivational quality variables

This analysis uses several variables that describe individual motivational qualities in order to strengthen the measure of these characteristics and test the robustness of their effects. The first motivational quality variable is 8th grade (base year) locus of control. I use locus of control measured in the base year because it is the earliest such measure and therefore less likely to be endogenous with respect to high school performance and college outcomes. Further, only about 70 respondents are missing base year locus of control data, compared to the over 1,000 respondents who are missing values for locus of control in the first and second follow up surveys that are used in other studies.

I use two measures of locus of control in my analysis. The first measure is a composite variable derived from student responses to the following statements: 1) In my life, good luck is more important than hard work for success, 2) Every time I try to get ahead, something or somebody stops me, and 3) My plans hardly ever work out, so planning only makes me unhappy. The second measure of locus of control is a composite variable that combines the above responses with responses to the following statements: 4) I don't have enough control over the direction my life is taking, 5) When I make plans, I am almost certain I can make them work, and 6) Chance and luck are very important for what happens in life. Responses were recorded on a four point Likert scale: strongly agree, agree, disagree, or strongly disagree. Responses to statement 5 were recoded with values in reverse order to correspond with the direction of the other statements. All responses were standardized to a mean of zero and a standard deviation of one. Higher values indicate more internal locus of control.

In addition to the generalized expectancy captured by locus of control, I include a specific measure of reinforcement value. The reinforcement value of academic work is based on first follow up survey student responses to the following questions: 1) Do you feel it is 'OK' to

work hard for good grades? 2) How important are good grades to you? Students were given the option of a yes/no response to the first item; responses to the second item were recorded on a four point scale: not important, somewhat important, important, or very important. Higher numbers indicate a higher reinforcement value of academic work.

The second motivational quality variable is base year self-concept, which I measure in two ways. The first measure of self-concept is a composite variable derived from student responses to the following statements: 1) I feel good about myself, 2) I feel I am a person of worth, the equal of other people, 3) I am able to do things as well as most other people, 4) On the whole, I am satisfied with myself. The second measure of self-concept is a composite variable that combines the above responses with responses to the following statements: 5) I certainly feel useless at times, 6) At times I think I am no good at all, and 7) I feel I do not have much to be proud of. Responses were recorded on a four point Likert scale: strongly agree, agree, disagree, or strongly disagree. Responses to statements 5, 6, and 7 were recoded with values in reverse order to correspond with the direction of the other statements. Like locus of control, all self-concept responses were standardized to a mean of zero and a standard deviation of one. Higher values indicate more positive self-concept.

The third motivational qualities variable is student test-taking effort. NCES administered low-stakes standardized tests to survey participants, i.e. the test results did not affect students' grades, chances of going to college, etc. Therefore, student test performance is a function of their willingness to exert effort in a low-stakes academic situation, in addition to their academic preparation. I derive a measure of test effort by using the residuals of a regression predicting standardized test scores based on grade point average (as a proxy for academic preparation), while holding locus of control, self-concept, and demographic characteristics constant. Low-

stakes test scores capture unincentivized effort, so the remaining variation serves as a measure of this student characteristic (Segal forthcoming).

The fourth measure of motivational qualities is exceeding educational expectations. NCES surveyed students (and parents) about the eventual level of education they expect (their children) to achieve. Parents have expectations of their children's future educational attainment; sometimes students surpass their parents' expectations. I derive a measure of exceeding expectations by using the residuals of a regression predicting students' educational expectations based on parents' expectations, controlling for grade point average, test scores, locus of control, self-concept, and demographic characteristics. Holding these other factors constant, student educational expectations reflect their extra motivation beyond what would be predicted.

The fifth motivational qualities variable used in this analysis is a measure of classroom effort. When evaluating students, teachers account for the amount of effort exerted in class, in addition to performance on tests and homework. I derive a measure of classroom effort by using the residuals of a regression predicting grade point average based on NELS achievement test scores, while controlling for other characteristics. The basic idea is that achievement test scores provide a one-time measure of academic performance, so they will account for the component of GPA that reflects academic ability. Grades capture a longer term indicator of motivational qualities like effort and motivation in school, so the remaining variation in GPA can be attributed to these qualities (Jacob 2002; Tyler 2008).

To summarize, I use several variables to measure motivational qualities and provide a check on the results. The measures are locus of control, self-concept, test effort, exceeding expectations, and classroom effort.

Control variables

NELS includes survey questions about a detailed set of background characteristics that serve as control variables in this analysis. Parents were surveyed about the highest level of education they had completed, their occupational status, and annual family income. NCES used these responses to construct a measure of SES.¹¹ This measure was standardized to a mean of zero and a standard deviation of one. Students provided information on their grade point average in English, math, science, and social studies from 6th-8th grade, which is used as a proxy for academic achievement.¹² As noted above, NELS administered a series of standardized subject area tests in math, reading, science, and a combination of history, citizenship, and geography. These test scores are used as a proxy for cognitive ability.¹³ Finally, I include control variables for sex and race.

Methodology

Model

I estimate the effect of motivational qualities on the dichotomous outcome of college degree completion by using logistic regression models. I estimate models of the following general form:

$$p[\text{BA}=1] = \frac{1}{1 + e^{-(\beta_0 + \beta_1 \text{MOTIV} + \beta_2 \text{GPA} + \beta_3 \text{SES} + \beta_4 \text{MALE} + \beta_5 \text{WHITE})}}$$

where $p[\text{BA}=1]$ is the probability that a student earns a bachelor's (associate's) degree; MOTIV is a measure of motivational qualities using different variables described above; GPA is grade point average reported in the base year; SES is family socioeconomic status, based on family income, parents' highest level of educational attainment, and parents' occupational status;

¹¹ In the base year, 8.1% of respondents had parents with missing data. For these cases, student responses to questions about parents' education, occupation, and income were used to calculate socioeconomic status.

¹² Other studies find a high correlation (0.8) between self-reported and actual GPA (Roderick et al. 2009).

¹³ I use the item response theory theta adjusted test scores in NELS.

MALE is a dummy variable for gender (MALE=1 is male; MALE=0 is female); and WHITE is a dummy variable for race (WHITE=1 is white; WHITE=0 is minority).

The log-odds specification is:

$$\log \frac{p}{(1-p)} = \beta_0 + \beta_1 \text{MOTIV} + \beta_2 \text{GPA} + \beta_3 \text{SES} + \beta_4 \text{MALE} + \beta_5 \text{WHITE}$$

where all variables are the same as described above.

Motivational quality measures

To create a measure of test effort, I estimate the following model:

$$\text{TEST}_i = \alpha_0 + \alpha_1 \text{GPA}_i + \alpha_2 \text{LOCUS}_i + \alpha_3 \text{SELF}_i + \alpha_4 \mathbf{X}_i + \varepsilon_i$$

where for each individual i , TEST is the student's score on the achievement test administered through NELS in the base year; GPA is grade point average; LOCUS is locus of control; SELF is self-concept; \mathbf{X} is a vector of individual demographic characteristics, including SES, race, and gender; and ε is a residual.

To create a measure of exceeding expectations, I estimate the following model:

$$\text{STU_EXPCT} = \alpha_0 + \alpha_1 \text{PRNT_EXPCT}_i + \alpha_2 \text{GPA}_i + \alpha_3 \text{TEST}_i + \\ \alpha_4 \text{LOCUS}_i + \alpha_5 \text{SELF}_i + \alpha_6 \mathbf{X}_i + \varepsilon_i$$

where for each individual i , STU_EXPCT is student educational expectations; PRNT_EXPCT is parents' educational expectations for their children; and all other terms are the same as above.

To create a measure of classroom effort, I estimate the following model:

$$\text{GPA}_i = \alpha_0 + \alpha_1 \text{TEST}_i + \alpha_2 \mathbf{X}_i + \varepsilon_i$$

where for each individual i , GPA is grade point average; TEST is the student's score on the achievement test administered through NELS in the base year; \mathbf{X} is a vector of individual demographic characteristics, including SES, race, and gender; and ε is a residual.

IV. Results

Locus of Control and Self-Concept

Descriptive statistics show that students who enroll in postsecondary education have higher than average locus of control (mean=0.111) and self-concept (mean=0.031). The majority of college enrollees in the sample are white (72%) and female (52%). As expected, these students also come from more advantaged backgrounds than the full sample (mean SES=0.10). About 49% of those who enter college complete an associate's degree, while 41% finish a bachelor's degree. (See Table 1.)

Focusing on college enrollees, basic correlations suggest a strong relationship between grade point average ($\rho=0.42$), socioeconomic status ($\rho=0.41$), and college degree completion, as expected. Higher grades and stronger family backgrounds are associated with earning a postsecondary degree. By comparison, locus of control ($\rho=0.19$) and self-concept ($\rho=0.08$) have much lower correlations with degree completion. The weak associations between motivational qualities and other control variables suggest that 8th grade locus of control and self-concept may have independent effects on college outcomes. For example, locus of control has a negligible relationship with being male or white. Similarly, self-concept has an insubstantial relationship with SES and being white. Also note the generalized expectancies measured by locus of control and self-concept have low correlations (0.16 and below) with specific beliefs about the importance of grades and working hard for grades. There is one exception: the correlation between locus of control and grade point average ($\rho=0.31$) is small to moderate. Students who feel their own actions determine outcomes are more likely to perform better in school and vice versa. (See Table 2.) I use multivariate regression analysis to further explore these relationships and control for different variables.

Logistic regression models on the subsample of 8th grade students who later enrolled in postsecondary education indicate that motivational qualities have a positive, statistically significant relationship with the probability of obtaining a bachelor's degree, even controlling for academic performance and demographic characteristics (see Table 3). (I obtain similar results when I examine the probability of completing an associate's degree, but motivational quality measures are not statistically significant for certain subpopulations. In the results that follow, I focus on bachelor's degree completion.)

The first model shows that grade point average is a strong predictor of degree attainment ($p < 0.001$). Students with higher grade point averages are more likely to earn a bachelor's degree, as expected. The addition of the first measures of locus of control and self-concept (Model 2) do not change the coefficient on the academic performance variable very much, which suggests these motivational qualities have an independent effect on degree attainment. Surprisingly, self-concept has a negative sign, which suggests that students with lower levels of self-concept have a higher probability of degree attainment. Model 3 shows the strong effects of family background: students from families with higher SES are significantly more likely to obtain a bachelor's degree ($p < 0.001$), as expected. Females ($p < 0.001$) and whites ($p < 0.01$) show a higher probability of degree attainment. Again, the inclusion of locus of control and self-concept (Model 4) produces little change in the demographic coefficients, which provides additional evidence of the independent effects of motivational qualities. Model 5 reveals the high correlation between grade point average and SES as the coefficients for each decrease when both variables are included in the model. The sixth model shows that locus of control has a positive, statistically significant effect ($\beta = 0.116$, $p < 0.05$) on the probability of earning a bachelor's degree, controlling for grade point average, standardized test scores, SES, gender, and

race. We would expect a 0.116 increase in the log odds of bachelor's degree completion given a one unit increase in locus of control, holding all other variables constant. In other words, the odds are 1.12 to 1 that a student with higher locus of control will complete a degree than a student with lower locus of control. The effect of self-concept is negative but not statistically significant.

Note that race is not statistically significant when grade point average is included in the model. This does not indicate that race has no impact but rather that differences in grades can account for different college outcomes among whites and minorities. Although men (48%) and women (52%) enter college in roughly equal proportions in the NELS sample, males are less likely to complete a bachelor's degree than females, controlling for background factors. The gap is likely due to lower academic ability, as seen in the descriptive statistics.

The addition of a specific reinforcement value measure pushes the generalized expectancy measure of locus of control out of statistical significance (see Table 4). In Model 2, I include student responses to the question, "How important are good grades to you?" This variable is used to proxy for how much an individual specifically values academic achievement. The importance of grades has a strong positive ($p < 0.001$) relationship with bachelor's degree completion; it reduces the coefficient on locus of control by almost half so that the latter variable is no longer statistically significant. This reduction suggests collinearity, although the correlation between the two variables is small ($\rho = 0.16$). Model 3 tests the effect of student responses to the question, "Do you feel it is 'OK' to work hard for good grades?" as another proxy for academic reinforcement value, but it is not statistically significant. The last column (Model 4) reveals that the specific academic reinforcement value captured by the importance of grades has a larger, more statistically significant effect on the probability of finishing a

bachelor's degree than the generalized expectancy measured by locus of control. Specific reinforcement values also reduce the effect of gender so that it is no longer statistically significant, which suggests that gender differences may operate through the mechanism of academic-oriented beliefs.

The results of the full model are fairly consistent across different estimation strategies. (See Table 5.) Locus of control has a positive and statistically significant ($p < 0.05$) effect on bachelor's degree attainment in both the logit and probit models. In the linear probability model, the coefficients are too small to reach statistical significance.¹⁴ (Note that the coefficients for all variables dramatically decrease in the linear probability model.) The effect of self-concept is negative but not statistically distinguishable from zero. GPA, SES, and sex all show the same sign and similar relative magnitudes across the logit, probit, and linear probability models. These consistent results support the finding that locus of control measured in 8th grade is a strong predictor of future college degree completion.

Test Effort, Exceeding Expectations, and Classroom Effort

I explore alternative ways to capture motivational qualities to provide new measures of these characteristics and to provide a check on the results above. These other measures of motivational qualities suggest a stronger relationship between these traits and the likelihood of obtaining a bachelor's degree. First, I measure test effort based on the residuals of a regression predicting NELS achievement test scores based on grade point average, locus of control, self-concept, family background, and demographic characteristics. (Note that a small set of variables (grade point average, SES, gender, and race) accounts for a large proportion of the variation ($R^2 =$

¹⁴ Coefficients are not directly comparable across the logit, linear probability, and probit models because of different assumptions in the estimation strategies. Coefficient sizes should be roughly similar in the logit and probit models because both use non-linear estimation. Coefficient sizes in linear probability models are typically smaller because the linear assumptions can lead to flatter slopes.

0.41) in students' test scores. See Appendix.) Logistic regression models using the residuals as a proxy for test effort reveal a positive, statistically significant effect ($\beta=0.042$, $p<0.001$) on the probability of completing a bachelor's degree, controlling for academic achievement and demographic characteristics. We would predict a 0.04 increase in the log odds of completing a bachelor's degree with a one unit increase in test effort, holding all other variables constant. In other words, the odds are 1.04 to 1 that a student with higher test effort will complete a degree compared to someone with lower test effort. (See Table 6.)

Second, I measure how students exceed expectations based on the residuals of a regression predicting students' educational expectations based on parents' educational expectations, grade point average, test scores, locus of control, self-concept, family background, and demographic characteristics. (Again, a relatively small set of variables explains much of the variation ($R^2=0.33$) in student expectations. See Appendix.) Logistic regression models using the residuals as a proxy for exceeding expectations reveal a positive, statistically significant effect ($\beta=0.133$, $p<0.001$) on the probability of completing a bachelor's degree, controlling for academic achievement and demographic characteristics. We would predict a 0.13 increase in the log odds of finishing a bachelor's degree with a one unit increase in exceeding expectations, holding all other variables constant. In other words, the odds are 1.14 to 1 that a student with a higher level of exceeding expectations will finish a degree, compared to someone with a lower level of exceeding expectations. (See Table 7.)

Finally, I measure classroom effort based on the residuals of a regression predicting grade point average based on standardized test scores, family background, and demographic characteristics. Logistic regression models using the residuals as a proxy for classroom effort reveal a negative, statistically significant effect ($\beta=-1.063$, $p<0.001$) on the probability of

completing a bachelor's degree, controlling for academic achievement and demographic characteristics. (See Table 8.) This negative relationship is unexpected given that the residuals should capture qualities associated with good attendance and classroom effort, which are factored into the grades that teachers assign. Further analysis shows that the residuals have a small correlation with student self reports about being late for school, skipping class, and cutting school. In other words, the residuals are capturing qualities that are harmful to academic success, which would explain the negative sign on the coefficient (see Discussion).

Differences by Socioeconomic Status

Of those who attended postsecondary institutions, students with lower SES trail their more advantaged peers across a number of measures (see Table 9). On average, low SES students have lower locus of control (0.036 vs. 0.192). However, locus of control is approximately normally distributed among high and low SES groups, which suggests that it is orthogonal to SES (see Figure 1). Students below the median level of SES have a mean grade point average that is 0.3 points lower than those with a higher level of SES. Low SES students are far less likely to obtain an associate's degree or higher (0.391 vs. 0.673) or a bachelor's degree or higher (0.266 vs. 0.614).

The effect of locus of control on degree completion for college enrollees is concentrated among students from low SES backgrounds. If I split the sample of 8th grade students who enrolled in higher education into groups above and below the median SES, I find that locus of control is statistically significant ($p < 0.05$) only for those from more disadvantaged family backgrounds (see Table 10).¹⁵ For high SES students, locus of control shows a positive effect but it is not statistically distinguishable from zero. Like locus of control, the female benefit is

¹⁵ If I use the full sample of college enrollees and include a two-way interaction term between locus of control and socioeconomic status, the interaction term is not statistically significant.

also concentrated among students from low SES families ($p < 0.01$). Although women are more likely to earn a bachelor's degree in both groups, the effect is statistically significant only for those from low SES backgrounds. Grade point average is more important, i.e. has a larger magnitude, for more advantaged students. The results suggest that low SES students benefit more from higher locus of control than more advantaged students (see Discussion).

V. Discussion

Effects of Motivational Qualities

Individual motivational qualities measured as early as 8th grade have an enduring, statistically significant effect on college outcomes many years later. For students who pursue postsecondary education, higher locus of control has a consistently positive effect on bachelor's degree completion, independent of student academic achievement, family background, and demographic characteristics. This relationship is robust to several different measures of locus of control. In addition, other 8th grade motivational qualities like test effort and exceeding expectations also predict whether a student will finish a college degree, even controlling for school performance and other variables.

The observed negative relationship between college completion and motivational qualities measured using residuals as a proxy for classroom effort can be reconciled with the above findings. It appears that these residuals are capturing maladaptive motivational qualities as they demonstrate small positive correlations with student self reports about being late for school, skipping class, and cutting school. The finding that maladaptive motivational qualities exhibit a negative impact on college outcomes is consistent with other studies of behavioral problems (Segal forthcoming).

In contrast with locus of control, the findings reveal that self-concept measured in adolescence does not have a statistically significant effect on future educational attainment. This result appears to run counter to earlier work (e.g. Goldsmith et al. 1997) that observes a strong association between self-concept and later outcomes, like wages. However, the potentially conflicting findings can be resolved: intuitively, self-concept should have a stronger relationship with earnings than educational attainment because employers may pay more for these qualities, especially in certain occupations (e.g. sales). In addition, the self-concept variable in NELS is a broad construct; individuals may possess very different domain-specific levels of qualities like academic self-concept (Harter 2001). Further, the self-concept variable may capture qualities like narcissism that are associated with higher earnings could be harmful for degree completion.

Locus of Control

Rotter's (1966) concept of locus of control has been widely used in recent studies in the economics and education literatures as a measure of motivational qualities or non-cognitive skills (e.g. Piatek and Pinter 2010; Baron and Cobb-Clark 2010; Blanden et al. 2007; Cebi 2007; Goldsmith et al. 2007; Heckman et al. 2006; Coleman and DeLeire 2003; Rumberger 2010; Lleras 2008). The popularity of locus of control is due, in part, to the existence of a well-defined, empirically tested category to describe motivational qualities that might otherwise be difficult to measure. Consistent with this previous work, I find that locus of control has a strong relationship with future outcomes, in this case, higher education attainment.

However, social learning theory indicates reinforcement values should be considered along with the expectancy measured by locus of control. Further, Rotter (1975) warns that generalized expectancies are broad; they may apply to a wide range of situations but the extent of their effect in a specific situation may be small. Indeed, adding academic reinforcement value

measures to the models renders locus of control not significant.¹⁶ This suggests that locus of control operates through the channel of domain-specific academic beliefs, which is consistent with motivation theory. Further, specific reinforcement values may be more important than generalized expectancies in the context of college degree completion. Indeed, a more sensitive measure of reinforcement value may have had more predictive value. It also indicates that results should be interpreted with caution in studies that solely use generalized expectancies like locus of control.

Policy Implications

The positive effect of internal locus of control on the probability of completing a bachelor's degree is concentrated among students from more disadvantaged family backgrounds, i.e. below median SES. In other words, these students benefit more from motivational qualities, even though their average level of locus of control is lower than high SES students. High SES students have many resources available to them for postsecondary success and a stronger family safety net to assist them. For example, more advantaged students typically attend higher quality schools so they have stronger academic preparation. Additionally, high SES students experience fewer financial hurdles to paying for college because of higher family incomes. In contrast, low SES students do not enjoy the same advantages, so they may rely more on motivational qualities to get through college than high SES students. The finding suggests that internal locus of control can help compensate—to a small degree—for limited family resources associated with low family income, parental education, and parents' occupational status.

College awareness programs

¹⁶ Recall that reinforcement value was measured using student responses to the following questions: “Do you feel it is ‘OK’ to work hard for good grades?” and “How important are good grades for you?”

Based on these results, programs that seek to raise college participation should address student motivational qualities, in addition to the typical focus on test preparation and financial aid. Previous work in psychology provides evidence that interventions can shift students from lower to higher levels of locus of control (e.g. Mink and Watts 1973). Similarly, individuals who engage in risky behavior at a young age can increase their ability to delay gratification as they get older (Romer et al. 2010). Building on this research, charter schools like the KIPP Academy teach students how to improve their self-control, in addition to offering traditional academic instruction. Community organization programs could help students succeed in college by helping to develop strong motivational qualities.

College admissions

The consistent effect of adolescent motivational qualities on degree completion has important implications for college admissions policies, because institutions may be missing many potentially successful students. Colleges and universities seek to expand access to higher education and promote socioeconomic diversity in their student bodies. But many institutions claim that their ability to serve low income students is limited by the low test scores in this group that do not meet admissions standards (Hill and Winston 2006). The results reported here suggest that students with strong motivational qualities will succeed in college even controlling for grades and test scores. Colleges that use motivational qualities in their admissions decisions could increase socioeconomic diversity in their student body *and* improve graduation rates.

Given that student motivational qualities may not be clearly revealed in traditional admissions criteria (e.g. standardized test scores), colleges should develop alternative measures. Scholars have developed motivational quality questionnaires that have proven to be consistent and accurate in repeated testing (Sedlacek 2004). Further, questions about locus of control, for

example, are less vulnerable to faking than naïve questions about how much students value good grades. The University of Maryland experimented with including measures of non-cognitive skills in their admissions process several decades ago (Sedlacek 2005). Currently, other institutions, including DePaul University and Oregon State University, are assessing applicants' motivational qualities in making admissions decisions. Further research is needed to evaluate the results of these admissions practices.

Threats to Validity

A key concern is that the apparent relationship between motivational qualities measured in school, e.g. locus of control, and college degree completion may be masking the effects of an underlying variable. In this case, the likelihood of earning a degree would be erroneously attributed to motivational qualities, instead of the omitted variable. I attempt to reduce omitted variable bias by including a rich set of controls for the factors that are both theorized and empirically demonstrated to affect degree completion, including academic performance, demographic characteristics, and educational expectations. Although this mitigates the risk of omitted variable bias, it of course does not eliminate it. Ultimately, it is impossible to definitively state that high motivational qualities cause college degree completion because these qualities are internal, i.e. they cannot be applied as a treatment and evaluated in a randomized controlled experiment.

In addition, responses to motivational quality questions may simply reflect certain aspects of a student's environment, which also affect the likelihood of earning a college degree. For example, students who have more educational materials at home or a strong academic environment at school may also have greater chances of obtaining a degree. To check this possibility, I add variables to the model that measure the availability of books and a computer at

home, as a proxy for household educational resources, and the proportion of school classmates that participate in college preparatory activities, as a proxy for school academic culture. The inclusion of these variables does not substantially affect the results. (See Table 11.)

Motivational qualities like locus of control may be affected by academic achievement. For example, success in school may lead students to feel a more internal locus of control. In this case, the effect of locus of control on college outcomes would be overestimated. Longitudinal data enables researchers to examine if there are changes in motivational qualities over time that correspond to changes in academic performance, family environment, etc. Previous work finds that increasing test scores are associated with more internal locus of control over time, which suggests this motivational quality may not be exogenous (Coleman and DeLeire 2003). To address this concern, I use motivational qualities measured early in the student's academic career. By studying the relationship between 8th grade motivational qualities and college degree completion, I eliminate the risk of reverse causality. Models using later measures (e.g. 10th grade locus of control) yield qualitatively similar results.

Construct validity is an important issue for any study of motivational qualities. The question is how well does a construct like locus of control capture the actual variable of interest? The Rotter locus of control concept and the survey questions asking about locus of control are well established in psychology. They are supported by decades of empirical work (Lefcourt 1976; 1981). Although these variables are necessarily measured with error, they appear to consistently capture underlying and enduring motivational qualities.

Student attrition poses a potentially important threat to the validity of the results. Students who did not participate in all five survey waves ($n=1,317$) were excluded from the analysis. The excluded group is more likely to be male, minority, and lower SES. Also, students

omitted from the analytic sample are less likely to graduate from high school (87%) and enroll in postsecondary education (67%). These students have a mean grade point average that is one-tenth of a point lower than students included in the analysis, although both groups exhibit similar average responses to the locus of control questions. However, the low levels of college enrollment in the excluded subsample suggest these students would not substantially affect the analysis. In addition, the NELS sampling design and adjusted survey weights account for student attrition. Consequently, the excluded group does not affect the generalizability of the results.

Missing responses are a major concern with any analysis using survey data. A pattern of non-response may be associated with important individual characteristics, which would bias the results. To reduce the potential bias from missing data, I take advantage of repeated survey questions in NELS. I improve on previous studies by using the base year measure of locus of control, which is only missing 70 responses. Earlier work relied on motivational quality measures from the first and second follow-up surveys, which are missing approximately 1,100 and 1,200 responses respectively.

VI. Conclusion

Low income students are less likely to pursue higher education and complete a college degree than high income students. Much research has examined differences in academic preparation but low income students possess valuable motivational qualities that are not always shown in grades and standardized test scores. These qualities are important for success in education and the labor market.

Using National Education Longitudinal Study data, I find that motivational qualities expressed in the 8th grade predict the probability of earning a bachelor's degree 12 years later.

Individual motivational qualities at an early age are important for success in higher education, independent of traditional factors thought to play a role, like family income, grades, and race. In particular, locus of control has a positive statistically significant effect on degree completion; this effect is more important for students from low SES families. I use several different measures of motivational qualities, including test effort and exceeding expectations, to test the robustness of the relationship. The results consistently show that motivational qualities have a statistically significant effect on the probability of earning a college degree, which provides additional support for the importance of motivational qualities.

The findings have several implications for higher education policies and programs. The college admissions process should attach a higher value to motivational qualities, particularly for low SES students, given that these qualities are strong predictors of postsecondary success. Also, programs should work to improve locus of control and motivation in young students to increase the chances of future college degree attainment. Policies to emphasize and improve motivational qualities could increase college graduation rates and help more low income students benefit from the rising college wage premium.

Tables

Table 1

Descriptive statistics (means and standard errors) for weighted sample of postsecondary enrollees (n=8,158)

Variable	Mean	Linearized Standard Error
Grade point average	3.060	0.016
Control over life	3.112	0.016
Luck vs. hard work	3.341	0.013
Obstacles stop me	2.901	0.015
Plans unhappy	3.111	0.014
Plans work	2.983	0.012
Luck important	2.832	0.016
Locus of control	0.111	0.014
Self concept	0.031	0.014
Male	0.483	0.008
White	0.722	0.012
Parents' education	3.297	0.031
Socioeconomic status	0.095	0.019
Education expectations	4.850	0.023
Sure graduate HS	2.864	0.009
Postsecondary plans	4.850	0.023
AA degree or higher	0.491	0.009
BA degree or higher	0.406	0.010

Note: Calculations based on NELS survey weights, strata, and sampling units

Table 2

Correlation matrix for variables measuring postsecondary participation (college attendance and degree completion), academic performance (grade point average), behavioral qualities (locus of control and self concept), achievement values (grades are important and work hard for grades), and demographic characteristics (socioeconomic status, gender, and race), for 8th grade students who later enrolled in postsecondary education.

	BA plus	GPA	Locus of control	Self concept	Grades imprnt	Work for grades	SES	Male	White
BA degree or higher	1.00								
Grade point average	0.42	1.00							
Locus of control	0.19	0.31	1.00						
Self concept	0.08	0.19	0.35	1.00					
Grades important	0.21	0.31	0.16	0.14	1.00				
Work for grades	0.05	0.10	0.07	0.04	0.19	1.00			
Socioeconomic status	0.41	0.26	0.14	0.05	0.06	0.05	1.00		
Male	-0.03	-0.07	-0.02	0.16	-0.08	-0.07	0.06	1.00	
White	0.12	0.08	0.08	-0.05	-0.09	-0.01	0.24	0.01	1.00

Table 3

Parameter estimates and approximate p-values for logistic regression models describing the relationship between behavioral qualities (locus of control and self concept) and the probability of earning a bachelor's degree, controlling for grade point average, socioeconomic status, gender, and race. Analysis based on the weighted sample of 8th grade students who later enrolled in postsecondary education.

	Earn bachelor's degree					
	(1)	(2)	(3)	(4)	(5)	(6)
Grade point average	1.605*** (0.066)	1.565*** (0.068)			1.455*** (0.068)	1.417*** (0.072)
Locus of control		0.182*** (0.053)		0.403*** (0.059)		0.116* (0.058)
Self concept		-0.097* (0.048)		0.107 (0.057)		-0.027 (0.052)
Socioeconomic status			1.264*** (0.065)	1.246*** (0.065)	1.136*** (0.059)	1.131*** (0.060)
Male			-0.375*** (0.076)	-0.360*** (0.081)	-0.215** (0.075)	-0.195* (0.077)
White			0.288** (0.097)	0.268** (0.094)	0.144 (0.091)	0.149 (0.091)
Constant	-5.469*** (0.222)	-5.363*** (0.227)	-0.632*** (0.087)	-0.679*** (0.086)	-5.156*** (0.241)	-5.065*** (0.252)
N	8583	8543	8505	8466	8460	8421

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Table 4

Parameter estimates and approximate p-values for logistic regression models describing the relationship between motivational qualities (locus of control and self concept), academic motivation (importance of grades and working hard for grades), and the probability of completing a bachelor's degree, for students who enrolled in postsecondary education, controlling for grade point average, socioeconomic status, gender, and race.

	Earn bachelor's degree			
	(1)	(2)	(3)	(4)
Grade point average	1.417*** (0.072)	1.292*** (0.076)	1.381*** (0.072)	1.294*** (0.076)
Locus of control	0.116* (0.058)	0.067 (0.061)	0.106 (0.058)	0.068 (0.061)
Self concept	-0.027 (0.052)	-0.06 (0.054)	-0.019 (0.052)	-0.06 (0.054)
Socioeconomic status	1.131*** (0.060)	1.132*** (0.062)	1.128*** (0.060)	1.134*** (0.062)
Male	-0.195* (0.077)	-0.139 (0.079)	-0.202** (0.077)	-0.139 (0.079)
White	0.149 (0.091)	0.229* (0.091)	0.143 (0.091)	0.228* (0.091)
Grades important		0.497*** (0.060)		0.501*** (0.060)
Work for grades			0.218 (0.266)	-0.144 (0.271)
Constant	-5.065*** (0.252)	-6.478*** (0.294)	-5.137*** (0.350)	-6.353*** (0.378)
N	10516	10137	10377	10127

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Table 5

Comparison of logit, probit, and linear probability models describing the relationship between behavioral qualities (locus of control and self concept) and the probability of obtaining a bachelor's degree, controlling for grade point average, socioeconomic status, gender, and race. Analysis based on the weighted sample of all college enrollees.

	Earn bachelor's degree		
	(1) Logit	(2) Probit	(3) LPM
Grade point average	1.417*** (0.072)	0.833*** (0.041)	0.237*** (0.010)
Locus of control	0.116* (0.058)	0.067* (0.034)	0.016 (0.010)
Self concept	-0.027 (0.052)	-0.015 (0.030)	-0.003 (0.009)
Socioeconomic status	1.131*** (0.060)	0.662*** (0.034)	0.199*** (0.010)
Male	-0.195* (0.077)	-0.117** (0.045)	-0.039** (0.013)
White	0.149 (0.091)	0.078 (0.053)	0.02 (0.015)
Constant	-5.065*** (0.252)	-2.962*** (0.142)	-0.338*** (0.032)
N	8421	8421	8421

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Table 6

Parameter estimates and approximate p-values for logistic regression models describing the relationship between test effort and the probability of completing a bachelor's degree, controlling for grade point average, socioeconomic status, gender, and race. Test effort is a measure of behavioral qualities derived from a regression of standardized test scores on grade point average and demographic characteristics. Analysis based on the weighted sample of 8th grade students who later enrolled in postsecondary education.

	Earn bachelor's degree		
	(1)	(2)	(3)
Grade point average	1.425*** (0.068)	1.398*** (0.071)	1.268*** (0.074)
Test effort	0.041*** (0.005)	0.042*** (0.005)	0.042*** (0.005)
Socioeconomic status	1.164*** (0.060)	1.162*** (0.060)	1.169*** (0.062)
Male	-0.193* (0.075)	-0.185* (0.078)	-0.132 (0.080)
White	0.111 (0.092)	0.100 (0.092)	0.193* (0.092)
Locus of control		0.118* (0.059)	0.076 (0.063)
Self concept		-0.024 (0.053)	-0.056 (0.056)
Grades important			0.525*** (0.061)
Work for grades			-0.243 (0.280)
Constant	-5.032*** (0.240)	-4.959*** (0.248)	-6.228*** (0.387)
N	8183	8183	7810

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Table 7

Parameter estimates and approximate p-values for logistic regression models describing the relationship between extra educational expectations and the probability of completing a bachelor's degree, controlling for grade point average, socioeconomic status, gender, and race. Extra educational expectations is a measure of behavioral qualities derived from a regression of students' educational expectations on parents' educational expectations, controlling for grade point average, standardized test scores, locus of control, self-concept, and demographic characteristics. Analysis based on the weighted sample of 8th grade students who later enrolled in postsecondary education.

	Earn bachelor's degree		
	(1)	(2)	(3)
Grade point average	1.446*** (0.071)	1.420*** (0.075)	1.309*** (0.078)
Extra expectations	0.148*** (0.039)	0.146*** (0.038)	0.133*** (0.040)
Socioeconomic status	1.171*** (0.062)	1.169*** (0.063)	1.168*** (0.065)
Male	-0.192* (0.076)	-0.183* (0.078)	-0.127 (0.080)
White	0.131 (0.096)	0.120 (0.097)	0.202* (0.097)
Locus of control		0.118* (0.058)	0.081 (0.062)
Self concept		-0.025 (0.054)	-0.059 (0.056)
Grades important			0.473*** (0.061)
Work for grades			-0.131 (0.282)
Constant	-5.131*** (0.256)	-5.061*** (0.265)	-6.308*** (0.392)
N	7773	7773	7423

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Table 8

Parameter estimates and approximate p-values for logistic regression models describing the relationship between motivational qualities and the probability of completing a bachelor's degree, for students who enrolled in postsecondary education, controlling for grade point average, socioeconomic status, gender, and race. The residuals are a measure of motivational qualities derived from a regression of grade point average on academic performance and demographic characteristics. Analysis based on the weighted sample of 8th grade students who later enrolled in postsecondary education.

	Earn bachelor's degree			
	(1)	(2)	(3)	(4)
Grade point average	2.209*** (0.117)	2.022*** (0.119)	2.173*** (0.118)	2.027*** (0.119)
Classroom effort	-1.105*** (0.134)	-1.059*** (0.138)	-1.100*** (0.136)	-1.063*** (0.138)
Socioeconomic status	0.991*** (0.064)	1.008*** (0.065)	0.989*** (0.064)	1.010*** (0.065)
Male	-0.087 (0.077)	-0.061 (0.080)	-0.099 (0.076)	-0.063 (0.080)
White	0.123 (0.090)	0.192* (0.094)	0.122 (0.090)	0.191* (0.094)
Grades important		0.497*** (0.061)		0.504*** (0.061)
Work for grades			0.086 (0.286)	-0.294 (0.283)
Constant	-7.536*** (0.374)	-8.741*** (0.390)	-7.482*** (0.451)	-8.489*** (0.462)
N	10219	9862	10092	9853

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Table 9

Descriptive statistics (unweighted means and standard deviation) by socioeconomic status for postsecondary enrollees

Variable	<u>High SES</u>		<u>Low SES</u>	
	Mean	Standard Deviation	Mean	Standard Deviation
Grade point average	3.260	0.628	2.965	0.694
Control over life	3.179	0.763	3.088	0.812
Luck vs. hard work	3.371	0.660	3.315	0.720
Obstacles stop me	2.985	0.704	2.828	0.756
Plans unhappy	3.191	0.719	3.036	0.784
Plans work	3.017	0.648	2.978	0.679
Luck important	2.914	0.831	2.702	0.899
Locus of control	0.192	0.642	0.036	0.707
Self concept	0.050	0.720	0.013	0.720
Male	0.484	0.500	0.428	0.495
White	0.768	0.422	0.603	0.489
Parents' education	4.111	1.060	2.434	0.795
Socioeconomic status	0.675	0.425	-0.558	0.465
Education expectations	5.221	0.827	4.556	1.183
Sure graduate HS	2.911	0.306	2.833	0.402
Postsecondary plans	5.221	0.827	4.556	1.183
AA degree or higher	0.673	0.469	0.391	0.488
BA degree or higher	0.614	0.487	0.266	0.442

Note: Calculations based on NELS survey weights, strata, and sampling units

Table 10

Comparison of students by socioeconomic status (above and below the median), using logistic regression models describing the relationship between motivational qualities (locus of control and self concept) and the probability of completing a bachelor's degree, controlling for grade point average, socioeconomic status, gender, and race. Analysis based on the weighted sample of 8th grade students who later enrolled in postsecondary education.

	Earn bachelor's degree	
	(1) HighSES	(2) LowSES
Grade point average	1.482*** (0.105)	1.341*** (0.087)
Locus of control	0.067 (0.086)	0.186* (0.076)
Self concept	-0.015 (0.069)	-0.044 (0.074)
Socioeconomic status	1.360*** (0.150)	0.836*** (0.136)
Male	-0.125 (0.107)	-0.299** (0.108)
White	0.208 (0.133)	0.155 (0.133)
Constant	-5.493*** (0.385)	-4.916*** (0.327)
Subpopulation N	4246	4175

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Table 11

Parameter estimates and approximate p-values for logistic regression models describing the relationship between behavioral qualities (locus of control and self concept) and the probability of earning a bachelor's degree, controlling for grade point average, socioeconomic status, gender, race, and school characteristics. Analysis based on the weighted sample of 8th grade students who later enrolled in postsecondary education.

	Earn bachelor's degree				
	(1)	(2)	(3)	(4)	(5)
Grade point average	1.417*** (0.072)	1.372*** (0.067)	1.394*** (0.070)	1.452*** (0.075)	1.448*** (0.078)
Locus of control	0.116* (0.058)	0.177** (0.056)	0.150** (0.056)	0.148** (0.057)	0.141* (0.060)
Self concept	-0.027 (0.052)	-0.017 (0.052)	0.009 (0.050)	-0.018 (0.052)	0.002 (0.055)
Socioeconomic status	1.131*** (0.060)	1.148*** (0.057)	1.061*** (0.057)	1.020*** (0.059)	0.988*** (0.062)
Male	-0.195* (0.077)	-0.248*** (0.072)	-0.281*** (0.069)	-0.278*** (0.073)	-0.277*** (0.076)
White	0.149 (0.091)	0.003 (0.102)	0.131 (0.093)	0.177 (0.100)	0.031 (0.114)
Percent white		0.111*** (0.033)			0.091* (0.038)
Percent free lunch			-0.268*** (0.051)		-0.05 (0.065)
Percent 4 year college				0.015*** (0.002)	0.013*** (0.002)
Constant	-5.065*** (0.252)	-5.158*** (0.249)	-4.487*** (0.262)	-5.763*** (0.279)	-5.832*** (0.339)
N	8421	7820	7472	6811	6240

Standard errors in parentheses

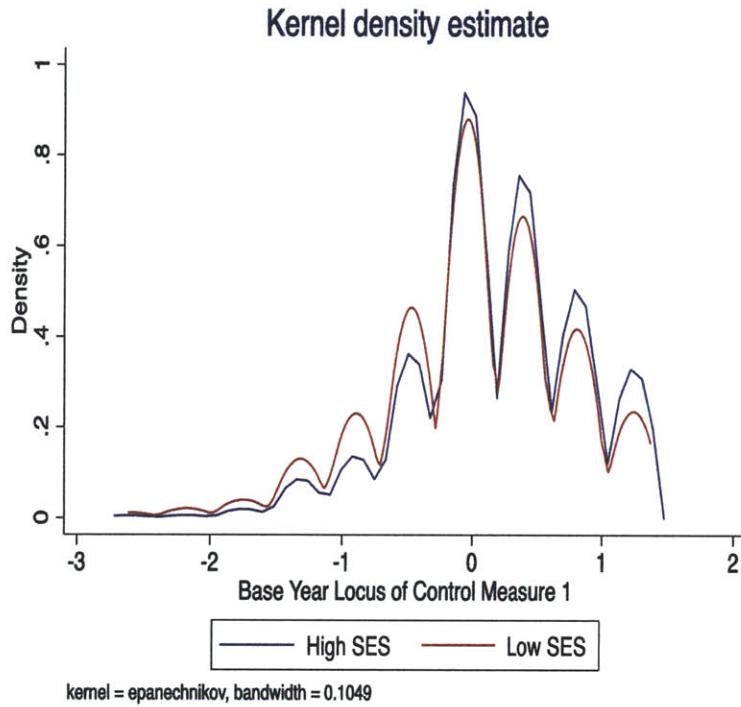
* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

Figures

Figure 1

Distribution of base year locus of control for students above and below median socioeconomic status in the sample.



Appendix

Table A

Parameter estimates and approximate p-values for OLS regression models describing the relationship between standardized test scores and grade point average, controlling for demographic characteristics, locus of control, and self-concept. Analysis based on the sample of 8th grade students who later enrolled in postsecondary education.

	Standardized test scores			
	(1)	(2)	(3)	(4)
Grade point average	7.844*** (0.134)		6.583*** (0.129)	6.294*** (0.135)
Socioeconomic status		5.354*** (0.131)	3.785*** (0.118)	3.705*** (0.118)
Male		-0.713*** (0.193)	0.100 (0.170)	0.293 (0.172)
White		2.929*** (0.213)	2.700*** (0.186)	2.501*** (0.186)
Locus of control				1.531*** (0.137)
Self concept				-0.695*** (0.127)
Constant	29.108*** (0.428)	51.554*** (0.195)	30.938*** (0.439)	31.739*** (0.453)
N	8399	8336	8293	8272
R ²	0.29	0.21	0.40	0.41

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table B

Parameter estimates and approximate p-values for OLS regression models describing the relationship between students' educational expectations and parents' educational expectations, controlling for grade point average, standardized test scores, locus of control, self-concept, and demographic characteristics. Analysis based on the sample of 8th grade students who later enrolled in postsecondary education.

	Student educational expectations		
	(1)	(2)	(3)
Parents' expectations	0.158*** (0.005)	0.137*** (0.005)	0.130*** (0.005)
Locus of control	0.205*** (0.016)	0.139*** (0.016)	0.118*** (0.016)
Self concept	0.128*** (0.015)	0.099*** (0.015)	0.108*** (0.015)
Socioeconomic status	0.299*** (0.015)	0.262*** (0.015)	0.229*** (0.015)
Male	-0.140*** (0.021)	-0.098*** (0.020)	-0.101*** (0.020)
White	-0.067** (0.023)	-0.085*** (0.022)	-0.121*** (0.023)
Grade point average		0.314*** (0.016)	0.252*** (0.018)
Test scores			0.011*** (0.001)
Constant	3.485*** (0.048)	2.708*** (0.062)	2.411*** (0.073)
N	8092	8053	7858
R ²	0.29	0.32	0.33

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Full Sample of 8th Grade Students and Subsample of HS graduates

Weighted descriptive statistics on the full analytic sample (see table below) show the demographic and educational characteristics of the population of 8th grade students attending schools in the U.S. in 1988. Whites comprise 71% of students; the population is almost evenly split between males and females. Almost 93% of 8th grade students in 1988 would go on to finish high school (receive a high school diploma, GED, or certificate of attendance) by 2000. About 78% of students enrolled in some type of postsecondary education after high school, including certificate or license programs, vocational institutions, two-year colleges, and four-year colleges. Over 30% completed a bachelor's degree or higher form of postsecondary education.

Table C

Descriptive statistics (means and standard errors) for weighted sample of all 8th grade students.

Variable	Mean	Linearized Standard Error
Grade point average	2.924	0.016
Control over life	3.082	0.014
Luck vs. hard work	3.292	0.013
Obstacles stop me	2.844	0.014
Plans unhappy	3.038	0.013
Plans work	2.956	0.011
Luck important	2.757	0.016
Locus of control	0.035	0.013
Self concept	-0.002	0.012
Male	0.495	0.008
White	0.708	0.012
Parents' education	3.071	0.031
Socioeconomic status	-0.071	0.020
Education expectations	4.582	0.024
Sure graduate HS	2.811	0.009
Postsecondary plans	4.582	0.024
HS graduate (2000)	0.928	0.006
Attend postsecondary	0.784	0.008
AA degree or higher	0.385	0.009
BA degree or higher	0.318	0.009

Note: Calculations based on NELS survey weights, strata, and sampling units

Table D

Descriptive statistics (means and standard errors) for weighted sample of high school graduates (n=9,600)

Variable	Mean	Linearized Standard Error
Grade point average	2.986	0.015
Control over life	3.093	0.014
Luck vs. hard work	3.312	0.012
Obstacles stop me	2.863	0.014
Plans unhappy	3.069	0.013
Plans work	2.966	0.011
Luck important	2.787	0.015
Locus of control	0.065	0.013
Self concept	0.016	0.012
Male	0.495	0.008
White	0.716	0.012
Parents' education	3.153	0.029
Socioeconomic status	-0.009	0.019
Education expectations	4.681	0.023
Sure graduate HS	2.842	0.008
Postsecondary plans	4.681	0.023
Attend postsecondary	0.833	0.007
AA degree or higher	0.415	0.009
BA degree or higher	0.343	0.009

Note: Calculations based on NELS survey weights, strata, and sampling units

Compared to the subsample of individuals who enroll in postsecondary education, locus of control has a stronger positive effect on bachelor's degree attainment in the full NELS sample and the subsample of high school graduates. The magnitude and statistical significance of the coefficients increase, likely because of the larger variation in locus of control in these groups. Compared to college enrollees ($\beta=0.116$), the coefficient for high school graduates ($\beta=0.178$) is 53% larger, and the coefficient for the full sample ($\beta=0.201$) is 73% larger. Locus of control is statistically significant at the $p<0.001$ level for the full sample, and at the $p<0.01$ level for high school graduates, but only significant at the $p<0.05$ level for college enrollees.

The decreased significance among students who attend postsecondary institutions may reflect the higher average locus of control in more educated subsamples. Above a certain threshold, relatively low levels of locus of control (i.e. external control) may not be harmful to educational attainment. One plausible explanation is that students who pursue college may compensate for lower locus of control with higher intrinsic motivation (e.g. Deci and Ryan 1985).

Table E

Comparison of full sample, high school graduates, and postsecondary enrollees in logistic regression models describing the relationship between behavioral qualities (locus of control and self concept) and the probability of obtaining a bachelor's degree, controlling for grade point average, socioeconomic status, gender, and race.

	Earn bachelor's degree		
	(1) All	(2) HSgrad	(3) AttendPSE
Grade point average	1.522*** (0.068)	1.481*** (0.069)	1.417*** (0.072)
Locus of control	0.201*** (0.055)	0.178** (0.055)	0.116* (0.058)
Self concept	-0.044 (0.050)	-0.051 (0.051)	-0.027 (0.052)
Socioeconomic status	1.344*** (0.059)	1.305*** (0.059)	1.131*** (0.060)
Male	-0.225** (0.075)	-0.217** (0.073)	-0.195* (0.077)
White	0.072 (0.086)	0.075 (0.087)	0.149 (0.091)
Constant	-5.570*** (0.241)	-5.403*** (0.243)	-5.065*** (0.252)
Subpopulation N	10420	9929	8421

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Note: Standard errors use Taylor linearization based on NELS survey weights, strata, and sampling units

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Awareness vs. Preparedness: College Guidance in Low Income Schools

Abstract

Low income students lack information about higher education options, the college application process, and financial aid opportunities. Previous work argues that high school counselors are a key resource for college planning, especially for students whose parents have limited college experience or social capital. Advocates call for increasing the amount of college information available to students so they can make informed decisions about postsecondary pathways. However, little work has studied what college information students do receive and how they use it. My research fills this gap by examining the types of college information high school counselors provide and how students process this information. Using a combination of participant observations and over 50 interviews with counselors, college awareness advisors, and students in low income public schools in the Boston area, I find that: 1) students have strong postsecondary aspirations, 2) student awareness of specific colleges is highly localized, 3) counselors and advisors focus on the mechanics of the college process, but 4) students are unaware of their academic performance, misinterpret facts, and lack context to make sense of the college information provided. The results suggest that schools must teach academic habits earlier so students can make effective use of college guidance information. This research contributes to the literature by revealing how scholastic under-preparation undermines the effectiveness of information interventions, and helps explain why degree completion is stagnant despite rising college enrollment.

Awareness vs. Preparedness: College Guidance in Low Income Schools

I. Introduction

Students from low income families possess less information about college and have a lower probability of enrolling in postsecondary educational institutions than students from higher income families. Low income students make inaccurate assessments about the cost of college and the availability of financial aid (Perna 2004; Avery and Kane 2004). In addition, low income students have less access to knowledgeable sources of information about higher education institutions and financing options (McDonough 1997; Kane 1999). Information constraints can lead students to make haphazard decisions about postsecondary enrollment that produce inefficient outcomes given the college-wage premium (Scott-Clayton 2012). Low levels of information about higher education are strongly associated with decreased enrollment in two-year and four-year colleges (Plank and Jordan 2001).

Previous work emphasizes the importance of guidance counselors in increasing students' knowledge about postsecondary options, especially for low income students (McDonough 2005a; Cabrera et al. 2005). High school counselors explain the mechanics of the application process, provide details about specific colleges, and help students find financial aid. Based on the positive relationship between college information and college enrollment, advocates have called for reducing student-counselor ratios, offering more counselor support, and generally increasing the amount of information provided to students. Scholars hypothesize that accurate information about the costs and benefits of college will raise student aspirations for higher education (Bergerson 2009; Long 2010). Similarly, more information about admissions procedures and financial aid availability should increase the proportion of students who apply to college (Perna 2004).

However, few studies have examined what college information is provided to students and how they interpret it. The push to increase the amount of college information available rests on a crucial assumption: students possess the skills and knowledge to make effective use of college related information. But if students are given more data about college admissions standards and they are unable to correctly process this data, then we would not expect the additional information to improve enrollment outcomes. Even if students are able to correctly process additional information about college, it may come too late to make a difference. For example, grade point averages (GPA) reflect cumulative performance during high school, so when students find out in their senior year that they need a 3.5 GPA to be admitted to their first choice college, it is often too late for them to meaningfully act on this information. For students who lack basic awareness of their academic achievement level in high school, more information about the mechanics of the college application process will be disconnected from their level of understanding. Further, if students misinterpret the relationship between their academic performance and their grades, then college enrollment may lead to negative outcomes, like dropping out.

My research examines how students receive and process college information from guidance counselors and advisors. I address the following research questions: 1) *What kinds of college information do counselors in low income high schools provide to students?* 2) *What level of information do students have about college and the college application process?* 3) *How do students access information about college?* 4) *How do students interpret college information?* The findings reveal that 1) students have strong postsecondary aspirations, 2) student awareness of specific colleges is highly localized, 3) counselors and advisors focus on the mechanics of the college process, but 4) students are unaware of their academic performance

(i.e. grade point average), misinterpret facts, and lack context to make sense of the college information provided. The findings have practical implications for education policy, namely that schools should instill strong academic habits earlier in students' careers so that they can make effective use of college guidance information. Academic habits include understanding and acting on the direct relationship between school effort and educational outcomes, which psychology scholars call effortful learning. This research contributes to the education literature by showing how scholastic under-preparation in high school undermines the effectiveness of information interventions, and helps explain why degree completion is stagnant despite rising college enrollment.

Importance of College Guidance Research

Understanding the role of information in postsecondary decisions is important because of the financial and social benefits of going to college. Improved access to information about college costs and scholarships can increase enrollment, which is associated with higher earnings (Long 2010). Large differences in college quality, resources, and fit, can lead to variation in student outcomes, so consumers need to make informed decisions about attendance (Morgan and Soares 2010).

In addition, public policy is increasingly focused on improving access to higher education. State and federal governments spend millions of dollars to provide information about college to high school students. Prominent foundations (e.g. Gates and Lumina) and non-profit organizations have invested heavily in efforts to improve college awareness and guidance. To ensure these policies are effective and that money is spent wisely, we need to understand how students process college information.

The rest of this chapter proceeds as follows. In the next section, I present the theoretical models that scholars have developed to understand how students make college choices. Then, I review previous evidence on the important role of information in influencing postsecondary decisions, especially for low income students who are least likely to possess adequate information about college and financial aid. Low income students often rely on schools and organizations for assistance with the college application process, so I describe efforts by guidance counselors and college awareness programs to enhance students' knowledge about higher education requirements. However, the emphasis on giving students more college information overlooks student ability to interpret and process this information. In the following section, I describe my research method, which consists of observations and interviews with counselors and students to understand how college information is used. Then, I present my findings and discuss the results. The final section concludes.

II. College Choices and Role of Information

Overview

Scholars have developed a series of models to understand the factors that influence students' postsecondary decisions. The models predict that students' information about college options has a strong effect on individual choices to pursue higher education. In particular, low income high school students have less access to college information, which is associated with reduced college attendance. Guidance counselors and college awareness programs seek to increase the amount of college knowledge that high school students possess. However, this focus overlooks how students process and make use of the college guidance information they do receive.

Theories of College Choice

Economists, sociologists, and education researchers have developed theories to identify the key variables affecting students' college choices. Scholars have proposed detailed models to describe student decisions about whether to apply to college and in which college to enroll (Hossler and Gallagher 1987; Chapman 1981). The various college choice models can be organized into three categories: 1) economic, 2) status attainment, and 3) combined (Hossler et al. 1989; Hossler et al. 1999; Plank and Jordan 2001; Perna 2006a; Bergerson 2009). Although these models are based on different underlying theories about individual behavior, they all posit that college decisions are strongly affected by the type and amount of college information an individual possesses.

Economic models

Economic models describe college choices as investment decisions made by individuals seeking to maximize the return on their investment (e.g. Fuller et al. 1982; Manski and Wise 1983; Kotler and Fox 1985; Kane 1999). Individuals compare the costs and benefits of college attendance in making their postsecondary education enrollment decisions (Paulsen 1990). Costs include tuition and fees, opportunity costs of foregone earnings, and the psychological burden of applying to and enrolling in college. Benefits include the net present value of expected future earnings and the consumption value of education. Economic models assume students and parents make rational decisions to maximize their utility based on individual tastes and preferences (Becker 1993). However, these decisions depend on the information available to individuals, which could be incomplete or inaccurate (Perna 2006a).

Status attainment models

Status attainment models of college choice are based on sociological theory that emphasizes how social structures and networks affect life outcomes (e.g. Sewell et al. 1969; Sewell and Hauser 1975; McDonough 1997). Sociologists argue that socioeconomic status (SES) plays a key role in determining individual decisions, access to opportunity, and future attainment of status (Bergerson 2009). In this model, postsecondary enrollment expectations and decisions are driven by the unequal distribution of education resources, including effective teachers and high school curriculum. In addition, high achieving students receive more encouragement from parents, teachers, counselors, and peers than low achieving students, which raises college aspirations (Perna 2006a). Students from low SES families are more likely to face limited guidance counseling opportunities and insufficient information about financial aid options because of low parental education, limited social capital, and under-resourced schools.

Combined models

Combined models of college choice incorporate aspects of both economic models and status attainment models (e.g. Hossler and Gallagher 1987; Stage and Hossler 1989; Perna et al. 2008). Combined models theorize that student decisions about higher education are driven by economic factors, like tuition costs and expected earnings, and sociological factors, like parental encouragement and guidance counseling (Perna 2006a). Economic and status attainment models typically treat college choice as a single decision; in contrast, combined models describe college choice as a series of stages (Stage and Hossler 1989, 303).

Combined models have proven to be effective in describing students' experience during high school as they consider their postsecondary options. Much of the scholarly literature has relied on some variant of the three stage model of the college decision making process: 1) predisposition, 2) search, and 3) choice (Hossler and Gallagher 1987; Terenzini et al. 2001;

Bergerson 2009). The predisposition stage covers student development of postsecondary education aspirations and interest in attending college. The search stage is comprised of locating and retrieving information about specific colleges. The choice stage involves the decision to attend a specific educational institution. Prior factors may affect student movement through all three stages of college choice. For example, subject-based academic tracking (Oakes 1990) can influence student predisposition to pursue higher education. Although the boundaries between the stages are not always distinct, the three stage model provides a useful framework for understanding the college choice process.

Differences for low income students

Traditionally, economic, status attainment, and combined models use a comprehensive approach to college choice, i.e. they treat all individuals the same, regardless of differences in family background. However, low income and low SES students have fewer resources at their disposal, which can affect how they perceive postsecondary options. Scholars have developed new models that recognize low SES students do not start from the same position as their more advantaged peers when making college decisions (Cabrera and La Nasa 2000; Perna 2006a; Bergerson 2009). For example, low SES students may have fewer educational resources at home and receive less support than wealthy students. (See Bryk et al. 1995 for examples of how schools can reduce these disparities.) Overall, these models attempt to more accurately account for differences in access and equity that affect postsecondary decisions for low income and minority students, so I rely on these newer theoretical models in my research.

Evidence on Impact of Information in College Choice

Empirical research has identified several key factors that affect the various stages of college choice: inability to pay for or finance the cost of college (Heller 2002; Hoxby 2004),

weak academic preparation (Ellwood and Kane 2000; Carneiro and Heckman 2003; Perna 2005), and inadequate information about college and financial aid (Kane 1999; Plank and Jordan 2001; Perna 2004).

Previous work has established the importance of student and parent information about the process of pursuing higher education (Hossler and Vesper 1993; Cabrera and La Nasa 2000; Grodsky and Jones 2007). College knowledge is necessary to navigate the application process and to be ready for postsecondary academic standards (Roderick et al. 2009). Policymakers and analysts are paying increased attention to the role of information because of the potential for relatively simple interventions to increase consumers' knowledge about facts like college costs, financial aid options, and application fee waivers (Scott-Clayton 2012; Bettinger et al. 2009; Dynarski and Scott-Clayton 2006; Avery 2010; Avery and Turner 2010). Programs to increase college information are also attractive because they can be implemented at a fraction of the cost of broad government intervention (Long 2010). Finally, technological developments like widespread computing and the internet have expanded access to information (Venegas 2006).

Types of college information

Recent efforts to increase college access focus on providing college-specific information to students and parents so they can better understand their postsecondary options, determine for themselves the best fit, and successfully apply to college. “Students and their families need reliable information in order to make the most of the choices that arise on the path to a college credential—particularly about the cost of college, the availability of financial aid, programs of study, career paths, quality, and return on investment” (Morgan and Soares 2010, 1). I categorize these types of college-specific information into three areas: 1) general awareness, 2) college knowledge, and 3) application mechanics.

The first category of college information, general awareness about college, refers to the understanding that postsecondary education is a potential option after high school. Individuals whose parents have limited schooling experience may not develop college aspirations because they did not know the possibility of higher education exists. Awareness includes information about the cost of attending college and the available opportunities to pay for it, e.g. financial aid. The second category, college knowledge, describes the facts and terms specific to higher education. Guidance counselors and community programs build on general awareness of the college option to focus on more detailed knowledge about institutional types and educational levels. For example, counselors help students understand the difference between two-year and four-year colleges, associate's degrees and bachelor's degrees, and public and private institutions. Similarly, community programs help families make sense of the array of college-specific acronyms, including EA (early action), ED (early decision), EFC (expected family contribution), and FAFSA (Free Application for Federal Student Aid). The third category, application mechanics, describes procedural information about the steps involved in applying to college. This category includes where to find applications, how to fill them out, how to apply for financial aid, and knowing who to ask for references. It also includes application requirements like registering for the SAT, taking the test, sending test scores to colleges, and writing personal statements and resumes.

Hypothesized effects of information on college choice

College information can affect postsecondary decisions during all stages of the college choice process. A lack of knowledge about the benefits of college attendance, like higher earnings, may lower students' aspirations for higher education. Similarly, parents who overestimate the cost of college may not encourage their children to pursue postsecondary

education. Gathering and comprehending college information can have the biggest effects during the search stage (Cabrera and La Nasa 2000). If students are unaware of the various types of postsecondary institutions, this may limit the number of colleges they consider. Further, unfamiliarity with the steps involved in the college and financial aid application processes may reduce the number of completed applications. Finally, limited information about financing options, including grants and loans, may lead students to enroll in institutions with lower sticker prices and fewer resources to support academic success or simply avoid college altogether.

As a result, scholars and educators have advocated for increasing the amount and quality of information available to students. “The assumption is that access to a range of reliable information encourages students to consider postsecondary education as an option” (Bergerson 2009, 49). In addition to raising aspirations, better college information will equip individuals with the tools to make better postsecondary choices. “The implication is that more accurate information could improve decision-making and increase college enrollment” (Long 2010, 8). Providing students with more information and guidance about the college and financial aid application processes may also encourage students to attend four-year colleges, where they are more likely to complete a degree than at two-year colleges (Plank and Jordan 2001).

Low Income Students Lack College Information

Previous work finds that students and parents possess inaccurate information about the range of potential college options (McDonough 1997), the cost of college (Avery and Kane 2004; Horn et al. 2003), and the availability of financial aid (Kane 1999). Empirical research indicates the level of information that students have about college is strongly related to family income.

Evidence of limited information and low enrollment

Students from high income backgrounds are more likely to have high levels of college information compared to their less advantaged peers. Students who are wealthy, have high ability, or have parents with higher education experience begin the college process earlier than other students (Litten 1982). Parents with high SES are more likely to have discussions with their children about going to college and are more likely to save for college (Stage and Hossler 1989). High income students often know more about tuition costs and financial aid, which they learn from parents and peers, exposure to college recruiters and college-outreach programs, and broader social networks (see Perna 2006b and references therein). Students attending wealthy schools are more likely to be aware of their own academic performance and college admission chances (Powell 1996; Avery and Kane 2004). Wealthier schools also provide more resources and encouragement to obtain college-related information (McDonough 1997), including college guidance centers and counselors dedicated to college advising (Lee and Ekstrom 1987).

In contrast, low income students possess less knowledge about college opportunities, costs, payment options, and benefits. Low SES students are less likely to know about tuition prices and sources of financial aid than high SES students (Perna 2004). For example, surveys of 11th and 12th graders in low income high schools in Southern California reveal that many students believe: a) college is too expensive for them to attend, b) financial aid is too complicated to apply for, and c) their grades are not good enough to receive college information (Luna De La Rosa 2006). Further, low income students make less accurate estimates about the benefits of college than other students (Paulsen 2001), even controlling for academic performance and parents' education level (Betts 1996).¹⁷ Other work finds that students in low income schools overestimate college tuition costs, average wages for college graduates, and

¹⁷ An experiment that provided information about the returns to education to 8th grade boys in the Dominican Republic resulted in 0.20-0.35 more years of schooling completed during high school (Jensen 2010).

future earnings, but that these mistakes are comparable to students in wealthy suburban schools (Rouse 2004; Avery and Kane 2004).

In addition to possessing low baseline levels of information, low income students also have fewer potential sources of information about college and financial aid (Kane 1999; Perna 2006a). Although many students visit college campuses, obtain college catalogues, and talk to friends about college options (Hossler et al. 1989; Litten 1982), low income students generally gather information about college from a small number of sources (Leslie et al. 1977; Tierney 1980; Horn et al. 2003; Grodsky and Jones 2007). Students from low SES backgrounds are less likely to use college newsmagazine guides in their college choice decision-making than high SES students (McDonough et al. 1998). Wealthy students are more likely to obtain college information from a wide range of informed sources, including parents, peers, and college representatives (Leslie et al. 1977; Terenzini et al. 2001). Further, low income students have less access to computers and college materials than wealthy students, who are more able to hire private counselors to guide them through the college application process (McDonough 1997). According to the Independent Educational Consultants Association, over 20% of students applying to competitive colleges use counseling outside of that provided at school (Avery 2010).

The low levels of college information among low income students are due in part to parents who often have limited college experience. Parents from low SES backgrounds possess less information about college and financial aid than high SES parents, which affects their children's access to this information (Terenzini et al. 2001). Other work finds that low income parents are also less familiar with various college financing options than high income parents (Perna 2006a).

There is a strong positive relationship between high school students' level of information and postsecondary enrollment. Students with higher levels of information and guidance are more likely to enroll in four-year colleges, as opposed to enrolling in two-year colleges or not enrolling in college at all (Plank and Jordan 2001). Further, controlling for high school grades, students' level of information and guidance explain a large part of the relationship between SES and college enrollment type (Plank and Jordan 2001). Other work reveals that low income students who gather financial aid information from one or more sources are more likely to prepare applications for four-year colleges than students who do not seek multiple sources of information (Berkner and Chavez 1997).

The limited sources of college information available to low income students makes it important to understand what information they do receive and how they obtain it. Therefore, I observe college guidance programs and interview students attending low income schools.

Importance of high school counselors

Counselors are a key source of information for students and parents trying to navigate the college application process. Counselors are instrumental in fostering a college-going culture, shaping student expectations about college, providing individual encouragement to students to pursue higher education, and influencing parent beliefs about postsecondary choices (Perna et al. 2008; McDonough 1997; 2005b). According to a recent survey, 65% of high school students state that counselors are one of their top sources of information about the requirements for success in college (MetLife 2011). Other work indicates that guidance counselors also have a strong influence on student decisions about which college to attend (Hossler et al. 1999).

Low income students are more likely to depend on their high school counselors for college guidance because these students have fewer or less-informed alternate sources of

information. Counselors form a crucial bridge to higher education by assisting low income and minority students whose parents and extended social network have limited experience with or knowledge about applying to college (Tomás Rivera Policy Institute 2004; Stanton-Salazar and Dornbusch 1995; Perna 2004). Also, counselors can be a source of social capital for students with weak social networks (Perna 2006a). In low income schools, guidance counselors are the primary source of information about college enrollment (Leslie et al. 1977; Cabrera et al. 2005). Research indicates that the availability of college counseling in high school is a major difference between low income students who enroll in college and those who do not (King 1996).¹⁸

High school guidance counselors have a disproportionate effect on the college information available to low income students. Consequently, my research examines the interaction between counselors and low income students to understand how college information is communicated and interpreted.

College awareness programs supplement counseling - NCAC

College awareness programs seek to enhance and reinforce the information that high school guidance counselors provide to students. These programs have been created by community organizations, postsecondary institutions, state governments, and the federal government. General college preparation and access programs are extremely important for low income and minority students, who are less likely to receive information and enroll in college (Bergerson 2009). Some programs, like the National College Advising Corps, specifically target underprivileged students.

¹⁸ Variation in resources and quality can limit the effectiveness of high school guidance counselors, especially in low-income school districts. At many schools, guidance counselors are burdened with administrative, curricular, and disciplinary responsibilities, which take time away from helping students with their postsecondary plans (Laturno Hines and Lemons 2011). In addition, counselor actions do not necessarily match their professional ideals. For example, 90% of counselors believe that their work should involve advocating for all students, but less than half feel that this level of advocacy actually occurs at their schools. Almost 70% believe counselors should ensure that low-income students receive necessary additional guidance, but less than one third of counselors report that this is the case at their schools (Bridgeland and Bruce 2011).

The goal of the National College Advising Corps (NCAC) is to improve postsecondary attendance among college-qualified low income students. The program recruits and trains highly motivated recent college graduates to work with high school students on postsecondary education planning. The emphasis on recent college graduates is an essential component of the near peer model; the program envisions that college guidance will be more effective if it comes from someone who is close to the student's age. As a former advisor puts it, "When a kid walks into my office and hears a 22 year-old who just finished college saying, 'You do it,' then it has a big impact. No offense, but no 40 year-old guidance counselor in the world has that kind of pull with these kids" (Lumina Foundation 2007). The near peer model differentiates the NCAC from other approaches like traditional high school guidance counseling and private consulting services for college admissions.

Participating high schools are primarily selected on the basis of two criteria; they must: a) have high student-to-guidance counselor ratios, and b) predominantly serve low income residents. Advisors are assigned to high schools, where they work full-time for two years and focus their energies on college advising. Advisors raise "college knowledge" among students by making class presentations and providing one-on-one guidance on obtaining college applications, applying for financial aid, and visiting campuses. While public school guidance counselors are typically burdened with overwhelming caseloads in addition to other administrative duties, staff members of the NCAC are solely engaged in raising college enrollment among low income youth. The program is administered in conjunction with local colleges and universities at more than 15 sites throughout the country.

Evaluation results are mixed

Scholars hypothesize that accurate information and consistent guidance can improve decision-making and increase college enrollment for low SES groups (Plank and Jordan 2001). However, there have been few rigorous evaluations of the effect of increasing college information and guidance for high school students.¹⁹ In addition, purely informational interventions yield mixed results (Scott-Clayton 2012). One randomized controlled trial assigned private college counselors to high-achieving students from lower income families. The treatment group received up to ten hours of individualized counseling, which had little effect on the quality of students' college applications and a small positive effect on applying to more competitive colleges (Avery 2010). The experiment was based on a sample of students who were potentially qualified for admission to Harvard, which limits the generalizability of the results. An unpublished study finds that students in schools participating in the NCAC program experience an 8-12 percentage point increase in college enrollment compared to schools that do not participate in the program (Bettinger and Antonio 2009). However, this study is based on comparison schools that did not take part in a controlled experiment, i.e. NCAC advisors were not randomly assigned, so the results could be due to pre-treatment differences in students, families, schools, and neighborhoods.²⁰

Outside community programs contribute additional information about college to low income students. As a result, I interview advisors in the National College Advising Corps to understand their role and perceptions of their impact on the higher education process for low income students.

How Students Process Information

¹⁹ Interventions that increase student exposure to advising during college show mixed effects (MDRC 2006; 2007; Angrist et al. 2009; Bettinger and Baker 2011).

²⁰ A forthcoming evaluation of the NCAC will use random assignment to schools in Texas (Supiano 2010).

Previous work has examined the sources of information that students receive about college, but has overlooked how that information is processed (Manski 1993). For example, a longitudinal survey of more than 300 high school students found that respondents most frequently learned about colleges from parents, friends, school guidance centers, and college brochures (Galotti and Mark 1994). A more recent survey of over 3,500 students in low income high schools found that the vast majority of students receive financial aid information from teachers, counselors, and coaches (Luna De La Rosa 2006). However, these studies do not consider how students interpret and make use of the information they receive.

Providing additional information about college may not be effective if students lack the ability to process this information, yet little work has explored this issue. Research based on national level data relies on broad measures of guidance that do not explore the quality and type of information provided or received (Plank and Jordan 2001). A study consisting of in-depth interviews of twelve high school seniors at four schools examined how family background, guidance counselors, and the organizational culture of schools affects student decisions about which college to attend (McDonough 1997). The study emphasizes how college choices are shaped by a complex constellation of structural and societal forces. Related work focuses on how student perspective and internalized beliefs can shape college expectations (Perna 2006a; Bergerson 2009). But these studies do not examine students' capacity to make use of college information and guidance.

Summary

Scholars have created several models, including economic, status attainment, and combined models, to understand the factors that influence how students make college choices. The models have helped to identify the important role of college information in affecting

postsecondary decisions. A lack of knowledge about the benefits of college attendance or inaccurate beliefs about tuition costs may lower college aspirations. Similarly, unfamiliarity with the college admissions and financial aid processes may reduce the number of applications a student submits. Low income students are least likely to have substantive, actionable college information, which is associated with decreased college enrollment. High school counselors and college awareness programs are an important source of college information, but little research has examined how students understand the information they do receive. More work is needed to determine what knowledge and skills students have to make effective use of college information.

Therefore, this study addresses the following research questions: 1) *What kinds of college information do counselors in low income high schools provide to students?* 2) *What level of information do students have about college preparation and the college application process?* 3) *How do students access information about college?* 4) *How do students interpret college information?*

III. Methods

Overview

To understand the role of guidance counseling information in postsecondary planning, I focused my study on high school guidance counselors, advisors in the National College Advising Corps, and high school students. I used a combination of individual interviews and participant observations of students and counselors engaged in guidance activities to obtain a more complete picture of the types of college information counselors provide and how students process that information.

Participants

Counselors

Guidance counselors ($n = 24$) were drawn from high schools in Boston and surrounding areas. Participants worked at 20 different schools in predominantly urban settings. The majority of the counselors were employed in the Boston Public Schools system. All counselors worked at regular public schools, charter schools, or pilot schools. Private schools were excluded from the sample.

Counselors were selected on the basis of working in public schools with: 1) college matriculation that were below the top quartile for the school district, and 2) at least 50% of the school population was low income (eligible for free or reduced-price lunch) or minority students. Although they serve a similar population of students, I excluded high profile college-preparatory examination schools with strong traditions of college attendance, like the Boston Latin School.

The purposeful sampling strategy helped to focus on counselors who were likely to be the primary source of college information for the student population they served. All of the high school guidance counselors in the sample indicated their main role was to advise students about postsecondary options. (Although counselors focused on college guidance, they also dealt with student behavior and academic issues.) Counselors had an average of 8 years of experience in their position. At the counselors' high schools, the average student-counselor ratio was approximately 260 to 1.

Advisors

Advisors ($n = 22$) were drawn from two different National College Advising Corps (NCAC) sites. The schools in these sites did not overlap with the schools where counselors worked, i.e. the advisors and counselors in my sample worked at different schools. Each advisor was assigned to at least one unique high school; a few advisors worked at multiple schools for a

subtotal of 24 schools. All of the schools were large public schools, with a mix of urban and rural locations. Most advisors had graduated from college during the previous spring so they were participating in their first year of the NCAC program. Advisors consisted of a convenience sample based on their availability and geographic location.

The NCAC targets high schools that serve low income communities and schools where guidance counselors are responsible for a large number of students. Further, the primary responsibility for advisors is to increase college awareness and enrollment among high school students. As a result, all NCAC advisors participating in the study experienced similar conditions to the sample of high school guidance counselors and served a similar student population.

In total, the counselor and advisor interviews formed a sample of 44 schools.

Students

Students ($n = 10$) were drawn in equal numbers from one high school in the Boston Public Schools system and one high school in a nearby school district. Both schools served predominantly low income and minority populations. All of the students were in their senior year of high school. The sample was almost evenly split between female (4) and male (6) students. Four students were Asian, three were African American, two were Latino, and one was white.

The high school students consisted of a convenience sample based on counselor recommendations and participation in college guidance programs. Counselors suggested students who they thought would be appropriate for the study and were willing to meet. These students were typically well informed about college in general and their specific college options, which was reflected in their advanced position in the application process. It is possible that

counselors recommended the students, in part, to serve as a positive reflection on college guidance counseling services at the high school. Therefore, the responses likely show an upward bias on students' level of understanding about college. To mitigate the selection bias from students chosen for interviews, I conducted observations of guidance counseling sessions that consisted of a broader range of students.

Procedures

Interviews

Counselors, advisors, and students participated in standardized, open-ended individual interviews. These interviews lasted approximately 40 minutes on average, from a minimum of 20 minutes to a maximum of one hour and 15 minutes. In addition, twelve advisors participated in one focus group interview that lasted 2.5 hours. All interviews were conducted during the 2011-2012 academic school year. I recorded all of the interviews by taking written notes. The notes were later typed for coding.

Observations

I conducted participant observations of students and counselors engaging in several types of college information and guidance activities (described below). The purpose of these observations was to study and examine the counseling process under typical conditions. I focused on the types of questions that participants asked, the interactions between students and counselors, and the areas where students appeared unfamiliar or expressed doubt. Also, I studied how students conduct college searches, obstacles they encounter, and how they deal with these problems.

The observations occurred both during regular school hours and after the school day had ended. I conducted observations during school hours at one school over the course of 3 days for

a total of 15 hours. I observed approximately 80 students in group settings and individual meetings. These observations took place at a high school in the Boston Public Schools system. I also conducted observations after school at other locations over the course of 7 days for a total of 17 hours. I observed approximately 50 students attending college information presentations and workshops. Observations outside of regular school hours took place at local high schools and at the office of a college awareness program. For observations both during and outside of regular school hours, I took handwritten notes in the field and wrote down additional details within 24 hours of the observations (Miles and Huberman 1994).

The observations during school and after school were instrumental in understanding how students actually engaged with the college guidance process. The observations enabled me to see the *depth* of students' understanding. As students participated in normal college preparation activities, they frequently revealed gaps in knowledge that did not necessarily come to light during interviews. Consequently, the observations provide as much—if not more—data as the interviews about student levels of college information.

The research procedures used in this study were approved by the MIT Committee on the Use of Humans as Experimental Subjects.

Measures

Interview responses

The individual interviews with counselors, advisors, and students were conducted in a semi-structured format. The questions were designed to tap the college topics that counselors and advisors cover; students' postsecondary plans and knowledge about the college application process; and broader beliefs about preparation for postsecondary education. Each interview consisted of a series of closed- and open-ended questions. (See appendix for interview

instrument.) For example, I asked counselors and advisors about the student-counselor ratio at their schools. In addition, I asked counselors and advisors to describe the college topics they covered in their work and their students' reactions. For students, I asked about which colleges they were applying to and what steps they had started. These questions led to open-ended questions about student expectations, how students use college counseling information, and the kinds of questions students ask when they first meet with counselors and later throughout the college advising process. The interview questions were intended to elicit a 'catalog' of the types of information that counselors provide about the college application process, the format in which the information is presented, the timing of when students receive various pieces of information, and how students view and proceed through the college process.

Given the relatively small number of students interviewed, I supplement the sample with counselor and advisor descriptions of students outside of the study. Counselors and advisors related many stories about other students who attended the low income schools where they were working. For the counselors and advisors, these anecdotes about other students exemplified the issues involved in providing college guidance.

The focus group interview with advisors also followed a semi-structured format consisting of closed- and open-ended questions. The group discussion occurred at a monthly meeting where advisors relate their experiences, provide updates on their progress, discuss challenges they have faced, and share ideas and strategies about how to increase their effectiveness. The focus group interview was intended to encourage advisors to reflect on the similarities and differences in their experiences based on the experiences of other advisors. The group format helped to validate responses by allowing direct participant feedback.

Observed interactions, discussions, and activities

During the school day, I observed four broad categories of the college counseling process: 1) college search, 2) individual student-counselor meetings, 3) college essay reviews, and 4) application submission. The first category, college search, involved four groups composed of approximately 20 students each who used the school computer lab to search for information about colleges and fill out applications online. These college search sessions were supervised by a team of 1-3 guidance counselors. The second category consisted of a series of individual meetings between students and counselors. Usually, the meetings were held in a one-on-one format, although other students waiting for an appointment were sometimes present. The meetings covered a variety of topics, including requesting letters of recommendation, registering for standardized tests, and meeting application deadlines. The third category, reviewing college essays and personal statements, consisted of counselors working on their own, reading over the materials submitted by students, and providing written feedback. The fourth category, submitting applications, involved counselors and assistants sitting side-by-side with students at a computer while the students completed their applications online and sent the applications to colleges.

Outside of school hours, I observed three different types of college advising activities: 1) outreach on paying for college, 2) help with college search and essays, and 3) assistance in applying for financial aid. The first type of activity, outreach on paying for college, consisted of college cost and financial aid awareness events that were held in the evenings at a public school. Approximately 30 students and parents attended each event, which featured presentations by community organizations on the cost of attending different types of colleges (e.g. two-year vs. four-year, public vs. private) and sources of financial aid, including scholarships, student loans, and work-study. The second type of activity, help with college search and essays, took place at a

college resource center established by a high school. About 20 students participated in this workshop, which took place weekly over the course of six months. The center provided computers for students to use in searching for information about individual colleges, creating a list of colleges to apply to, contacting admissions officers with questions, and writing college application essays. Staff and volunteers were available to work with students individually and provide assistance. The third type of activity, assistance with financial aid applications, involved trained volunteers helping students complete the Free Application for Federal Student Aid (FAFSA). Approximately 15 students attended this event, where volunteers would sit with students at a computer and help them fill out their financial aid applications online.

In summary, I conducted over 50 interviews with high school guidance counselors, advisors, and students. In addition, I supplemented the interviews with observations of more than 120 students during school hours and after school. My findings consist of a composite picture of student knowledge that emerges from a combination of direct interviews and detailed participant observations.

Coding

I used standard content analysis and inductive techniques to examine the data recorded from the interviews and observations. First, I developed a series of initial codes based on the counselor, advisor, and student interviews. After reading through the interview transcripts multiple times, I identified core themes and subthemes (Miles and Huberman 1994). The themes that emerged were: 1) college aspirations and expectations, 2) distance and geography, 3) college information, 4) basic knowledge about performance, 5) information processing, and 6) the relationship between effort, grades, and college. Then, I applied the coding in a systematic

fashion to all of the interviews and observations. The coding generated patterns across participants, which were further developed through additional content analysis.

Reliability and Validity

To strengthen the reliability of the data collection, I conducted all of the interviews myself using the same protocol and a standard interview format (Babbie 2004). During the interviews, I would restate responses to make sure I understood them correctly. This informant feedback increases the reliability of the data. As various themes emerged from the data, I checked these themes with participants. This process tested if the themes were repeated elsewhere and helped confirm patterns (Strauss and Corbin 1990). To increase the validity of the findings, I gathered perspectives from multiple participants, namely counselors, advisors, and students. In addition, the participant observations help corroborate the data obtained from the interviews, which also strengthens the validity of the findings.

IV. Findings

The findings show that while counselors review the components of the college application process, some students cannot make effective use of available information because of academic under-preparation. Schools, teachers, and parents should help build academic habits earlier in students' scholastic careers so they can achieve a level of skill and performance that enables them to effectively use information about postsecondary options.

College choice models theorize that limited awareness of college options and application procedures form a barrier to postsecondary enrollment. The models imply that if students are given more or better information, they will enter college in greater numbers. For example, students interested in attending a given college may not know the admissions standards, which prevents them from applying. Counselors or college websites will typically provide numerical

information about the range of test scores and grades for admitted students. For students who have the mathematical skills, this information can be very useful. They can estimate their own chances of admission and compare the costs and benefits of submitting an application. But students lacking these quantitative skills will not benefit from college admissions data in the same way. This second group of students may avoid applying to the college or they may submit an application even though it is not a good match for their academic preparation.

The conclusion of this research arose out of six specific themes. The first theme that emerged is that students have strong interest in higher education, although the reasons are not always clearly articulated. The second theme is that student awareness of specific colleges has a strong spatial component that is highly localized. The third theme from the research is that counselors provide extensive college information and most students are familiar with the steps involved in the college application process or this information is easily accessible online, i.e. there are few gaps in college information. The fourth theme in the study is that students often lack fundamental knowledge about their school performance, which hinders their ability to make use of college information from counselors and other sources. The fifth theme that emerged is that students are skilled in obtaining college information, but they do not interpret the information correctly or fail to act on it. The sixth theme from the data is that students reveal academic under-preparation regarding the relationship between classroom effort, high school grades, and college admissions standards.

My findings advance the debate in the scholarly literature, which argues that information barriers prevent more students from participating in postsecondary education. My results reveal that important skills and habits, not specific information about colleges or applications, pose major obstacles to student success. The process starts long before senior year as students must

develop the habits that increase aptitude and academic performance, which put students in position to capitalize on information about colleges. This research contributes to our understanding of how students can be slowed down in their pursuit of postsecondary education despite high aspirations and increased college information.

Strong College Interest

Consistent desire to go to college

The first theme that arose in the interviews and observations is that all students express strong interest in postsecondary education. (There was extensive overlap in the responses from counselors and advisors, so in the sections that follow I do not differentiate between the two sets of participants.) As one counselor described it, “Ask a 9th grader, ‘Do you want to go to college?’ [Their response is] ‘Oh yeah, I want to go to college!’” Students are not only aware of college as an option after high school, they expect to enroll. According to another counselor, “Every student, the first thing out of their mouth is ‘O.K., I’m going to college.’” For the majority of students, the opportunity to attend college clearly exists. As a third counselor explained it, “There are 3,500 colleges in the U.S. ... and [there are] so many concentrated in the [Boston] area. It’s not like Nevada or Wyoming.... If you want to go to college...you can go to college.” All of the students I spoke with were planning to attend college after high school. These students were working on applications for either two-year or four-year colleges, suggesting they had moved beyond college interest to college aspirations.

Student interest in pursuing higher education is reinforced by consistent societal messages about the importance of attending college. Counselors noted that students have heard they should go to college. As one counselor observed, “Adults in schools make a big deal about college, so students want to go.” According to the counselors, the general student attitude about

going to college is “I’ve heard about it, I’ve been told it’s a good thing to do, other people are doing it.” One counselor put it more bluntly: “Kids have had the idea of college drilled into their heads....That’s what society says: college, college, college.” Several schools initiate their college awareness programs in the 9th grade “so students buy into going to college” as soon as they have entered high school. The campaign continues through advisory classes in the sophomore and junior years of high school so that students “get a consistent message about college.” Interviews with students indicated that they had internalized the message from teachers, counselors, and parents that they are “supposed to go [to college].” One student asked me what colleges he should apply to, which suggested he had made the decision to pursue higher education. The other students I spoke with had already formed their college lists, which indicated they had progressed even farther along in their postsecondary planning.

Student interest moved beyond desires about going to college in general to clear preferences for attending specific colleges. For example, one student I spoke with said she always wanted to attend MIT and it was “my dream” to go there. Another student, who had conducted an extensive college search, spoke passionately about attending Oberlin College—it was her “number one.” All of the students I spoke with named specific colleges they were interested in, as opposed to simply describing a desire to attend “college” in the abstract. One student appeared less attached to any particular college. He expressed strong interest in continuing with the ROTC program he was involved with during high school; he limited his college search to those institutions that advertised an active ROTC program on campus. Nearly every counselor described a few students who indicate their intention to go to college by mentioning a specific school regardless of the realistic chances of admission at that school, e.g. students with low grades and test scores who nonetheless say, “I’ll just go to Harvard.”

Unclear reasons for going to college

Although students express a strong desire for postsecondary education, the reasons for attending are not always clear to some of the students. Some students have been told they should go to college and accept they should go, but were unable to articulate clear reasons why they should go. At times, the responses were positive but somewhat vague: “I want to be successful [in life]” or “I want to make myself proud.” When asked where he wanted to go to college, one student named a local university. When asked why he wanted to attend this particular school, the student said because “I walk by it all the time.” Further probing revealed he had not actually visited the college nor had he taken a campus tour. In contrast, other students expressed strong occupational aspirations. Two students told me they were going to college to become engineers. Another student said he wanted to be a lawyer.

Sometimes, the student rationale is based on misinformation about the education requirements for various occupations. Although I did not see direct evidence of this misinformation from the students I spoke with, several counselors related anecdotes on this topic about their other students. For example, one counselor noted, “When you ask students what they want to do in college, they say ‘I don’t know,’ or ‘I want to be a carpenter,’” i.e. they do not realize that a person does not need a college degree to become a carpenter. Another counselor described a similar, if more extreme scenario: “I have students who are interested in cosmetology and they want to go to MIT!”

A few schools have used arguments about financial benefits to encourage students to pursue postsecondary education. One high school intentionally emphasized the connection between higher education and higher earnings potential. Through classroom discussions, announcements, and posters, students were consistently reminded that bachelor’s degree holders

earned far more than those whose education ends with a high school diploma.²¹ So students were presented with specific, concrete reasons and information about why they should attend college in addition to the general directive that they should attend college.

Spatial Dimension to College Awareness

Local college information

The second theme is that geography affects the sources of college information that students are exposed to and their notions of distance in considering colleges. Student knowledge about specific colleges and universities is strongly influenced by geographic proximity to these institutions. The physical context of campus locations introduces many students to the idea of postsecondary education. Three counselors pointed out that their high schools are located near large universities or along major bus and train lines that pass by large universities so students encounter these institutions everyday on their way to school. One counselor explained that students are interested in nearby colleges because “those schools are in the area, so that’s what they hear, that’s what they know.” Further, some high school students participate in SAT preparation classes or extracurricular activities that take place on the campuses of neighboring colleges.

Counselors noted it is cheaper and logistically easier for them to arrange visits to local colleges, as opposed to elsewhere in the state or region. At one high school, funding constraints limited all college visits to those institutions that are accessible by public transportation. A counselor described how her students would benefit from enrolling in colleges located in small towns away from Boston but the problem is that students do not have an opportunity to visit

²¹ Information about potential earnings benefits was not limited to four-year degrees. At this school, counselors also encouraged students considering certificates or other postsecondary education, e.g. by highlighting that master electricians are paid higher wages than regular electricians.

these colleges. For colleges, it is also more convenient and cheaper to send representatives to a nearby high school than to a distant one.

Concepts of distance

In thinking about where to go to college, students expressed a strong attachment to the urban area where they went to high school. The students in my sample indicated they preferred in-state colleges over out-of-state colleges because of lower tuition costs, but the college choice set was even more localized. Several students mentioned they were looking at schools in Boston, including Northeastern, Bunker Hill Community College, and University of Massachusetts-Boston, so they could be close to home. Almost all counselors noted that their students were unwilling to go outside of the area for postsecondary education. “Kids don’t tend to want to leave Boston...it’s what they know, what they’re comfortable with, [they] don’t want to leave [their] comfort zone.” Other counselors said it is “a challenge to get students to think outside of [the city]” and it is the “hardest thing to do.” According to counselors, this reluctance is due in part to parental preferences and family ties, especially for immigrant students.

Students’ perceptions of distance and their limited travel experience reduces the number of college options available to them. Students wondered, “How will I get home on weekends?” if they attend college in another state. Counselors noted that students have a “fear of going out in the world.” Places like Maine and Vermont were considered “scary,” while “New Hampshire might as well be Australia!” Five counselors mentioned that their students had never been on a plane, left the state, or been away from home: “our kids don’t like to venture out, they’re not sure, they haven’t gone on vacation.” “Some have never left their area.” Four counselors recounted stories of former students who initially left the state to attend college but then transferred to lower tier colleges in Massachusetts so they could be closer to home. Others

mentioned students who turned down scholarships to attend selective out-of-state universities because their parents wanted them to stay closer to home.

Unfamiliarity with local geography also limited the number of institutions that students considered attending. One student from a Boston area high school noted that his parents would not allow him to attend the University of New Hampshire because it was too far away from home. However, when asked by a counselor if his parents would find the University of Massachusetts at Amherst acceptable, the student indicated they would, even though Amherst is located 25 miles farther away from Boston and less accessible by transit. Some student misperceptions about location seem perfectly reasonable in the absence of knowledge and exposure to area-wide postsecondary institutions. A counselor noted that students hear the name “Boston College” and they think of a big city setting but they do not realize that the college is located in a nearby suburb.

The Boston region offers a variety of postsecondary options for those who do not want to leave the area so student fit becomes very important. Several counselors stated that Boston is a “mecca” for higher education and “there are *so many* schools” that students do not know. The heterogeneity in size, programs offered, and selectivity can result in mismatches if students do not make informed decisions. One counselor provided a vivid analogy to explain the importance of finding the right college environment for students: “you pick the right pair of shoes, you enjoy walking in them. If not, it’s painful.”

Gaps in College Information

It was rare to find holes in students’ factual knowledge about college and the application process. For example, students were aware of the distinction between public and private colleges, the option to use the common application, and standardized tests like the SAT and

ACT. Students understood that they could start at a two-year college and then transfer to a four-year college.²² They knew that personal statements, transcripts, and letters of recommendation had to be submitted with their applications. The students I spoke with were familiar with specialized college terminology regarding admissions; two students freely used these terms in conversation. At other high schools, counselors reported that they needed to explain to their students that the SAT and ACT are essentially interchangeable and can be taken more than one time. One possible reason for the knowledge gap is that the college process has its “own lingo, it’s a language.” Specialized terms like early action and early decision might be foreign to students, especially those coming from families with limited college experience.

All students were familiar with specific colleges, particularly those located nearby, but they were not always aware of the special characteristics of some of these colleges. For example, one student flatly stated to a counselor, “I can’t go to a religious school.” The counselor probed a bit and eventually asked, “Would you go to BC [i.e. Boston College, a school with a Jesuit, Catholic mission]?” The student responded, “Of course!” Although students were aware of many colleges in the area, their level of knowledge about these institutions did not always extend to important characteristics.

All counselors reported that their high schools made use of non-profit organizations and community-based programs designed to encourage college attendance among disadvantaged youth. In my sample alone, counselors mentioned a large number of programs, including Access, Avid, Bottom Line, College Scholars, Gear Up, Posse Scholarship, Talent Search, The Education Resources Institute (TERI), and Upward Bound. These programs seek to raise general

²² However, there was some variability among schools. For example, one counselor noted that she previously worked at a high school where students did not know the difference between community colleges and four-year colleges and even put Harvard Medical School on their list of four-year colleges.

college aspirations among students and to increase student knowledge about individual colleges that might be a good fit.²³

Unaware of Own Academic Performance

The fourth major theme that emerged from this research is that some students lack fundamental knowledge about their own academic performance. High postsecondary aspirations and an informed approach to the college application process were tempered by lack of knowledge or inaccurate estimations of students' own grade point average. During college advising sessions, students *in the fall of their senior year* would ask counselors to tell them their current grade point average. The frequency of these questions led some counselors to print out a list of names and GPAs so the information would be readily available when students were searching for colleges or completing applications.²⁴

Knowledge about grade point averages was highly variable. A counselor described one senior who was strongly interested in going to college but was simply unaware of her current grade point average in high school. The counselor asked her to calculate her GPA, which came out to 2.1; the student was surprised and devastated. The counselor noted that students “don’t realize that Cs and Ds won’t cut it [i.e. will not be enough to qualify them for admission to most four-year colleges].” Most of the students I spoke with knew their high school grade point average, likely because they had already begun filling out their college applications. However,

²³ Inadequate information about financial aid options and the complexity of the application process may limit many students from pursuing postsecondary education. Boston public schools attempt to directly address this issue by partnering with an organization that provides free financial aid advice and counseling. Access Boston places financial aid advisors in each school once per week to help students find aid. Advisors sit side-by-side with students to help them fill out FAFSAs and apply for scholarships.

²⁴ However, sometimes it was difficult even for counselors to obtain this information. One counselor reported that, until only a few years ago, she did not have access to student transcripts and had to request information about a student's grade point average from another school staff member. Even then, the information was only made available twice each year.

one of these students told me his grade point average as a percentage, i.e. on a scale of 1-100, as opposed to using the traditional 4.0 scale. He may have had accurate estimations of his academic performance, but had not translated that measure into the one used by colleges, which would enable easy comparisons. Students who demonstrate awareness of their grade point average nonetheless may have difficulty in interpreting what their grade point average signifies. As one counselor described it, “for some kids, GPA is [only] a number.... [It] doesn’t mean much outside of context.” The problem goes beyond a lack of awareness to a lack of skills.

A few students I observed lacked the knowledge and understanding to calculate their grade point average. They either did not know that ‘A’ = 4.0, ‘B’ = 3.0, etc., or they did not realize that their grade point average is composed of all of the grades they earned during high school, including any dual enrollment programs. Counselors at three schools noted that students were not taught how to calculate their GPA until their sophomore or even junior year of high school.²⁵ By this point in the student’s academic career, it becomes increasingly difficult to improve GPA because of the large proportion of grades already accumulated. One counselor described how students express regret when they wait until their senior year to learn their GPA: “‘I could’ve done better in 9th grade!’”

Information vs. Use

The fifth theme that appeared in the interviews and observations is that students have access to information but do not necessarily make effective use of it. Students can use computers at school to search for colleges and complete their applications. In addition to

²⁵ In a few schools, counselors themselves provided classroom instruction on how to calculate GPA. Students used their own transcripts to learn how to perform the calculations and also become aware of their own score. Another school created a dedicated program to not only show students how to calculate their GPA, but also to make an explicit connection between their freshman year grades, their GPA by senior year, and the standards for admission to college. Of course, teaching students how to calculate their grade point average does not guarantee that students will check it each year or even remember how to perform the calculation. According to one counselor, “we bring it up freshman year [how to calculate GPA], but senior year they’ll go, ‘Huh?’”

individual college websites, aggregator services like the College Board, Peterson's, and Cappex compile information about over 3,000 college and universities in one place. These services also provide search tools to help identify postsecondary institutions that match a given student's background, grades, test scores, academic interests, and career goals. All of the students and counselors reported using internet resources to obtain information about colleges. However, there were some basic stumbling blocks. Many counselors reported (and observations confirmed) that it was common for students to forget their username and password needed to log in to their account on these websites.

Using information

Despite the various sources of college information available, students demonstrated some difficulty in using and interpreting the information. During my observations at one high school, I noticed that nearly all students used the College Board website to locate information about colleges, compare relevant characteristics, and compile a college list. But the website provides many helpful tools beyond its one-stop college catalogue function. For example, the College Board offers a feature called "How Do I Stack Up?" that allows students to compare their own academic performance with the performance of recently admitted students to a chosen college or university. Students can simply input any combination of information about the subjects they have taken, the number of classes in each subject, class rank, grade point average, and standardized test scores. The website produces charts and bar graphs that show where the student's scores fall within the distribution of admitted students. Two student interviewees who were fairly advanced in the college search process nonetheless were unfamiliar with this tool even though they regularly used the College Board website and the link is clearly displayed on

each college listing page. In this case, helpful information that could make the college search process more efficient simply was not being used.

Interpreting information

Some students who were faced with relevant college information did not know how to interpret this information or interpreted it incorrectly. For example, the College Board website lists the proportion of entering first year students who are in the top 10th, top quarter, and top half of their high school graduating class. This information is included on the main page for each college listing. I observed as many students used the website to look at specific colleges but did not understand what the percentile values meant. A few of the students I spoke with could not explain how to correctly interpret the figures.

For colleges that make additional information available, the website also lists the proportion of entering first year students who had high school GPAs in quarter point ranges from 2.5 to 3.75 and higher, and test scores for admitted students at the median, 25th, and 75th percentiles. At one level, it appeared that students had trouble with the concept of percentiles. At another level, students did not make the connection between their own scores, the percentile ranges of admitted students' scores, and their own chances of admission to a given college. Other websites make use of graphical displays, like line and pie charts, to present data about college admissions chances. However, I observed several students who did not make the connection between their position on the chart, the range of admitted students, and their probability of admission. In another situation, the College Board website includes a simple table for each college that lists the proportion of students who submitted a standardized test score as part of their application. After looking at this table, a student asked me, "this is the probability

of getting in, right?” Despite the information being readily available, this student misinterpreted the meaning of it.

Some sources of information may have the opposite of their intended effect. For example, Naviance is a proprietary software program that shows the admissions outcomes for students who applied to a given college from the same high school during previous years. The graphical display uses Xs and Os to indicate rejection and acceptance, based on GPA and standardized test scores on the axes. One of the students I spoke with saw that most classmates with a similar combination of GPA and tests scores were rejected. But the discovery that a few were accepted raised her hopes about her chances of admission. However, the program only provides GPA and test score information; it does not show athletic scholarships, alumni legacy status, or other factors that might explain why previous students who were below the college’s admission standards were nonetheless accepted.

Understanding questions

There were also challenges in understanding information during the process of completing college applications. It was common for counselors to report that “[some students] don’t know what the application questions are asking.” One specific area where students had trouble was questions asking about intended major in college. Sometimes, the college application questions were ambiguous or used abbreviations that students did not understand. For example, the online application for one college included a question asking about the applicant’s intended enrollment type. On the webpage there was a dropdown menu that listed a series of options using shorthand to describe day, evening, full time, and part time enrollment. I observed one student who was so confused by the array of options that she interrupted her application.

Extracting information

When presented with obvious opportunities to acquire more knowledge about colleges, students do not always glean relevant information. Some students want to pursue postsecondary education but they do not even know what questions to ask. One counselor recounted how she has to remind students when they attend college fairs to ask representative questions as basic as whether or not the college offers the major in which the student is interested. Several schools arrange for their students to visit colleges, listen to a presentation from the college admissions office, meet with current students, take a campus tour, and eat lunch at the college dining hall.²⁶ A few counselors observed that “the experience gets lost.... Students don’t remember or take away anything.” Students used general language to describe the trips that did not reveal any significant impressions. One counselor recounted that she conducted a survey that included questions on student reactions to a college fair. Many students reported they had never attended a college fair, even though the school had previously arranged the class trip and the counselor verified the list of students who attended.

Disconnect between Performance, Grades, and College Expectations

Counselors described how students experience some conceptual hurdles to attaining the goal of going to college. Counselors articulated the conceptual problems in various ways: students do not know how to “obtain” college; students are “saying it [i.e. they want to attend college], but don’t necessarily know what it is until junior year”; students “say it, hear it, [but] it takes awhile for them to actually believe it.” According to counselors, many of their students “have the attitude that it [college] is a word, a concept.” Another counselor felt that students

²⁶ The last component, “the ever popular campus lunch,” is a big hit according to counselors. Students are “blown away” that meal plans are all-you-can-eat and that they can go back for a second helping. In some cases, this seems to be the most memorable part of the entire college visit experience.

have a fundamental gap in understanding: “they [students] don’t know what *college* means.” This knowledge about what college entails is different from knowledge about how to apply to college.

Thus, the sixth theme that was apparent from the interviews and observations is the disconnect between students’ understanding of their academic performance and educational outcomes. The disconnect takes two forms: 1) a weak connection between academic performance and grades, and 2) individual academic performance does not match expectations for attending specific colleges.

Own performance and grades

Students misperceive the relationship between their classroom performance and teachers’ evaluations of that performance, i.e. grades. Several students indicated they were giving minimal effort in high school and mentioned how easy they found school work to be, even though their grade point averages were relatively low. For example, one student with a ‘C’ average said his classes are easy and his teachers do not push him very hard. Yet students express surprise at the low grades they received, despite acknowledging they exerted little effort in class. A few students believe that the same approach they used in high school will work in college, e.g. “Oh, I got a ‘C,’ no problem.” Also, students expressed unwillingness to take more rigorous classes in high school, e.g. “I don’t want to take Physics. I don’t want to take Calculus. I’ll do it in college.” These attitudes may reflect several ideas: a) a belief that students can simply ‘turn on’ their ability when they get to college, b) an assumption that college coursework will not be significantly more difficult than high school, and c) limited awareness that some colleges require a certain level of coursework for admission or at least that it would aid a

student's chances of admission. These ideas are speculative and point to fruitful avenues for future research.

The disconnect was apparent when students learned their GPAs. During a lesson on how to calculate grade point average based on their actual transcripts, students incredulously asked questions such as, "How come my GPA is low?" The counselor responded, "Well, look at your transcripts." Despite having their course records and grade information right in front of them, students seemed genuinely surprised by the GPA figure. Student reactions suggested not only that they were unaware of their GPA but they were also missing the connection between their perceived level of achievement and the numerical measure of their performance.

Many counselors raised concerns about the disconnect between academic effort, grades, and test scores. One counselor observed that students "underestimate what it means to be successful in high school." Another counselor stated, "[students] aren't taking it [i.e. grades] seriously and don't even realize [how important they are]." Several counselors indicated it was "common to have students who don't score well or test well." For example, students with a GPA of 3.6 or even 3.8 may have SAT scores that do not reach 800. Similarly, students receive good grades in their advanced placement (AP) courses but they are not successful on the AP exam. A counselor at one large school described being able to "count on one hand the number [of students who received high scores on the AP exam]." The weak academic performance in high school raises concerns about student chances of success in college. As one counselor flatly stated in a hypothetical conversation with a low achieving student, "If I had a four-year college, I'd let you in—but you'd fail!" From the counselor perspective, lower performing students are not investing enough time, energy, and effort into their class work in high school.

Academic preparation and college expectations

Another gap exists between students' academic performance to date and their expectations of attending a college or university. One counselor noted that "they [students] expect...it's supposed to be this way. I'm supposed to get in [to college]." Nearly every counselor described instances of students with low grades or test scores and overly ambitious college plans. According to one counselor, "For the most part, students have unrealistic expectations" about the type of school to which they will likely be admitted. There were many examples of "overreaching," i.e. highly unlikely but not completely implausible. Most of the colleges that students expressed interest in were local institutions with very high admissions standards. The student who dreamt of attending MIT wanted to apply there despite having SAT scores that were several hundred points below the 25th percentile SAT scores of accepted students. Another student applied to Harvard and told me it was his top choice even though over 90% of students admitted to Harvard have a GPA over 3.75, but his GPA was below that figure. Other common examples included students with a grade point average of 2.0 who wanted to go to Boston College, where the median GPA of entering students is much higher. There were also students "with Cs and Ds [who] say 'I think I'm going to U Conn,'" i.e. the University of Connecticut, where almost 80% of entering students were in the top quarter of their high school class. At one school, nearly one dozen students applied to state public colleges and universities even though their GPA was below 3.0, the established and highly publicized level required for admission to Massachusetts public institutions.

Counselors described the "disconnect" between students' positive view of their own high school performance and college admissions standards: "A 2.5 GPA to them [students] is good, but they want to go to BU [Boston University]." In other words, student standards do not match college standards. Another counselor concurred: "[students] don't realize how competitive it

[college admissions] is.... They think, ‘I’m a pretty good student.’” When asked about their chances of admission, a typical student response is, “Oh, I’ll get in, no problem.” Students with low grade point averages (e.g. 2.0-2.5) maintain these beliefs even after being presented with information about admissions standards at potential colleges. There is a gap in their understanding between what students believe to be good grades and what grades are required for admission to colleges that are moderately selective or higher.

Counselors described occasional instances of students stating interest in colleges where their chances of admission would be essentially zero based on their prior academic record. Examples included a student with a 1.7 GPA who wants to go to Princeton and another student who has Yale on his college list despite having a ‘C’ average. One student I spoke with is considering several Ivy League colleges despite having a grade point average that was below 3.0. Similarly, other “students have top name colleges on their list, even though their GPA is 2.5 and [their] SATs are 300-400s.... They have ... MIT [on their list] but they’re failing all their science classes!” Not only were students’ expectations much higher than their own performance, they did not match the historical trends at their schools. For example, at one high school only one student in the past four years has been accepted and enrolled in Boston University, yet students continually say, “Oh, I want to go to BU.” In general, students possessed strong postsecondary aspirations, but their expectations about specific colleges did not match their academic preparation.

V. Discussion

Educators and policymakers have encouraged ‘college for all’ despite concerns that higher education may not be the appropriate route for every individual (Rosenbaum 1998). Students in low income schools consistently express a desire for postsecondary education and

show interest in specific institutions, which indicates that they have absorbed the college message. In order to translate postsecondary interest into enrollment, counselors have focused on increasing the amount of college information available to students who may not otherwise receive it from their parents, peers, or social networks. The basic idea is that if students and parents are equipped with more information about the benefits and costs of college, they will make better postsecondary decisions. My research sheds light on an overlooked aspect of the information problem. Schools have ignored the processing skills, context, and academic preparation that are necessary for students to make effective use of college information. Without these key factors, more information about college will have limited usefulness. In one sense, information interventions are out of sequence. Processing skills, context, and academic habits must be put in place first, before college information is delivered. Otherwise, educators risk setting up students for failure later down the road, e.g. students who apply to college but do not enroll or enroll but do not complete a degree.

Keys to College Choice

College aspirations vs. expectations

Student interest in applying to specific postsecondary institutions indicates that the broad concept of college is being translated into more detailed plans to attend. In terms of theoretical models, students have moved from predisposition to search in Hossler and Gallagher's (1987) three stage model of college choice. Students are not only aware that college is a viable option after high school, they clearly aspire to attend.

However, college aspirations represent what students wish for; they do not account for the likelihood that those wishes will come true. Students may verbalize positive college aspirations to reflect what they believe counselors and other adults want to hear (Avery and Kane

2004). Aspirations should be compared with intentions, which are more grounded and realistic (Adelman 1999).

In my interview sample, students created lists of colleges to which they were applying and identified their first choice college by name, which shows a deeper attachment than simply saying “I want to go to college.” In some cases, students had naïve expectations attached to a particular university, but they also acknowledged a healthy range of college options. All of the students I spoke with were actively working on applications to be sent to a predetermined set of colleges, which indicates a high level of commitment. The application forms, personal statements, and resumes indicate a concrete college plan, i.e. a tangible representation of student intentions to attend a given college. By engaging in these aspects of the college application process, students were doing the hard work of implementing their plans.

Information readily available

Counselors have taken great effort to deliver college information to their students, especially in low income schools. Counselors teach students about the different college categories, degree types, and financial aid options. They also walk students through the steps to complete their applications. Students demonstrate an awareness of postsecondary options and an understanding of college application procedures, which undermines the idea that inadequate information forms a major obstacle to realizing higher education goals.

My findings contrast with previous work that argues more information is the solution to low college enrollment among low income students. For example, education scholars claim, “Most students need more basic information such as how to choose a college, figuring out what kind of college would suit them, whether to go away or stay at home for college, etc” (McDonough et al. 1998, 531). Similarly, economists have hypothesized that high school

students may be unaware of the college wage premium (Rouse 2004; Avery and Kane 2004), otherwise the strong financial incentives of obtaining a bachelor's degree would lead more students to pursue postsecondary education.²⁷ Sociologists contend that stratification leads to limited knowledge about how to navigate the college application process, which would explain why relatively few low SES students apply (Plank and Jordan 2001; Roderick et al. 2009). Students may have strong desires to attend college but unfamiliarity with the required steps and reduced awareness of institutional types may temper aspirations. Also, limited knowledge about financial aid could hinder college application and enrollment. However, the students I interviewed and observed were familiar with different college types and the application process. Counselors delivered and reinforced this information through class presentations, one-on-one meetings, and handouts.²⁸

Barriers to College

Despite strong college aspirations and available information about application procedures, students experience several obstacles to realizing their postsecondary plans: 1) awareness is limited to local colleges, 2) information is not processed correctly, and 3) important academic habits are missing.

²⁷ Increased awareness of the college wage premium may encourage more students to consider higher education, but it is not a necessary condition. Many students aspire to enroll in college because of family norms, peer influence, intellectual interests, or they have been told to, i.e. without having a precise understanding of the earnings benefits that accrue to degree holders (Bergerson 2009; Perna 2006a; Cabrera and La Nasa 2000).

²⁸ Even if they lack detailed knowledge about colleges and the application process, students can and do make use of rich sources of information, especially computing technology. The internet has made information about the college application process readily available (Venegas 2006) and has vastly expanded the amount of data students can obtain. Although low income students are less likely to have computers and internet access at home than wealthier students, which may create barriers to obtaining college information online, public schools make computing resources widely available (Becker 2000), especially for the college search and application processes. Previous work finds that low income students in urban schools report having access to computers at school, libraries, or elsewhere (Venegas 2006). There are also numerous other sources of information available, including guidebooks and magazines (Morgan and Soares 2010). In addition, the proliferation of nonprofit organizations dedicated to expanding college access has increased student awareness about postsecondary options (Bergerson 2009).

Limited local awareness

Low income students are typically aware of only a small number of colleges that are located in their neighborhoods or along their route to school, so their information set is limited. These results are consistent with recent work that finds that low income students in Chicago are familiar with a handful of colleges within a geographically confined area (Roderick et al. 2011), which constrains college choices. Even in a college-rich area like Boston, there are pockets with few higher education campuses so low income students may not have direct contact with many colleges and universities. As a result, student awareness may be skewed by exposure to only one or two institutions.

Further, there is great heterogeneity among postsecondary institutions (Smith 2008), so students may be exposed to size, price, and reputation characteristics that do not meet their preferences. As a result, low income students may become interested in and apply to colleges that do not match their needs or have few resources to support student success. The next chapter in this dissertation explores this issue in more detail by examining the independent impact of college selectivity on student outcomes.

Information processing deficits and missing context

Education researchers advocate for increasing student access to information, but ignore student ability to make use of information. For example, recent work critiques “the assumption that low income students have the information and support they need to respond to new [financial] incentives and opportunities” (Roderick et al. 2011, 179). Similarly, analysts identify “three main reasons why students and parents may not use information...in their college choices: [1] Lack of access to information—students and families are not aware of the information sources available to them. [2] The information that is available is not what students and parents

seek when making college choices. [3] Information is not presented in a way that is relevant to individual students' decisions" (Morgan and Soares 2010, 2). But these explanations assume that students possess the capacity to effectively process any information they receive about college.

When students encounter relevant college information, they often lack the skills to correctly process this information, which limits its usefulness. Further, increasing the amount of information provided to students will be ineffective if they do not possess the required processing ability. The internet and computing technology have already made huge amounts of college materials available. Students demonstrate skills in locating college information online but struggle with correctly interpreting it. For example, individual colleges and aggregator websites provide information about admitted students to help applicants estimate their likelihood of admission but a lack of analytical skills hinders students from making sense of the data provided. Even when college admissions information is presented in alternate formats, students do not accurately process the information. Schools must teach students the skills to interpret college information if they are to transform postsecondary aspirations into successful college outcomes.

Even for students who do possess these skills, college information is often provided without the appropriate context. Counselors teach students about the various types of colleges, but this information can easily become a series of disconnected facts. Schools do not always provide students with a framework to locate these facts and make sense of them. The clearest example is GPA. Many of the students I observed and interviewed did not know their current GPA, did not know how to calculate it, did not realize it was cumulative, or some combination of the three.

If students are unaware of their GPA, it suggests they are missing an important connection between high school and college. The GPA figure provides a measure of performance that links effort, ability, and academic standards in high school. As one counselor observed, “A lot of students, unfortunately, weren’t seeing the connection [between their academic performance] and college.” Students need to know their academic standing in order to act on information about college options, admissions, and applications. For example, students may learn that the average GPA of incoming students at a particular college is 3.5, but this fact is not useful if you do not know your own GPA is 2.5. The context is necessary for students to make comparisons and accurately assess their admissions prospects. Without this context, students are collecting disparate facts but have difficulty deriving their meaning.

Academic under-preparation

The lack of knowledge about students’ own GPA reveals a broader educational problem: academic under-preparation. High school students who are not aware of their current GPA are not only missing a crucial piece of information for the college search process, they are also missing an important measure of their academic performance. Many students express surprise when they learn how low their GPA is. They suddenly become aware of the disjunction between their internal evaluation of past academic performance and their teachers’ evaluation of that performance. If students do not translate their perceived scholastic achievement into an external measure, it is difficult for them to gauge improvement or the need for improvement.

Interviews and observations revealed that students were not always exerting full effort in classes and college applications. The previous chapter provides empirical evidence on how effort plays a significant role in academic achievement, independent of ability, family

background, and demographic characteristics. Schools must help students understand and internalize the relationship between effort and academic performance, as measured by grades.

Academic preparation involves strong academic habits, i.e. understanding and acting on the relationship between school effort and grades. Psychology research calls this effortful learning, which consists of seeing the relationship between efforts and outcomes. Effortful learning and academic habits are part of a process that must be developed over time—at least four years—if students are to achieve success in postsecondary education. Ideally, these skills and habits would be taught at the beginning of formal schooling, e.g. through rigorous homework practices. Schools must ensure that students recognize the relationship between the effort they invest in their schoolwork and their grade point average (GPA) so they can put themselves in a position to benefit from college awareness and application information. In other words, for college application guidance to be most helpful, schools must first help students develop strong academic habits so they can identify what a reasonable expectation is and then work toward earning a GPA that is high enough to get into college. College information delivered in the senior year may benefit the small segment of students who have good grades and academic skills but are missing crucial knowledge about how to apply. For students without strong academic habits, their limited understanding of college information may lead them to enroll in less selective institutions that have low graduation rates. These colleges can harm student chances of completing a degree (see next chapter).

The sociology literature provides one explanation why high school students who are interested in college are nonetheless missing these academic habits. Previous research indicates that differences in social capital, as revealed through parental networks, characterize how middle-class and working-class parents differ in their interactions with the school system (Horvat

et al. 2003; Lareau and Horvat 1999). Other work suggests cultural capital influences student success in high school and higher education (DiMaggio 1982; DiMaggio and Mohr 1985). Students with lower levels of social or cultural capital may not receive messages about the significance of high school grade point average for college admissions.

Policy Interventions

Student ability to make sense of college information can be improved, but recent proposals focus on the information side of the problem. For example, one paper emphasizes providing after-graduation employment data, earnings figures, and other information relevant to college decisions (Long 2010). In addition, the content and the format of college information in guidebooks and websites can be improved and made more user-friendly. Educators have called for making this information easier to understand so that students can become more informed consumers. Other observers have suggested interventions to help students develop preferences about college variables like quality (Morgan and Soares 2010). Simpler information and stronger preferences may improve college enrollment outcomes but they do not address academic habits and the ability to process information, which are important for success during and after college.

Counselors have developed techniques to help students acquire relevant information from situations where this information is available, like college fairs and visits. At several schools, counselors give students a list of possible questions to ask college representatives. Previously, many students attending the fairs would not approach college representatives or would not ask any questions, in part because they were not even aware of the type of information they should be trying to obtain. One counselor requires that students come back with proof (e.g. a business card or brochure) that they researched colleges and spoke with representatives at a fair. These

simple strategies increase the capacity of students to extract relevant college information from information-rich opportunities.

The gap in knowledge about GPA can be remedied through modest interventions. At a few schools, students and counselors observed that transcripts list final grades for all completed courses but do not provide a numerical grade point average or instructions on how to calculate this figure. Adding a section to individual transcripts that highlights students' cumulative grade point average would be a start. Another way to encourage students to recognize the relationship between grades and college admissions is to better publicize this connection.²⁹

There is a tougher challenge in improving students' understanding of the link between their effort in school, grades, and college standards. Students believe they can attend college even if their academic performance is weak, which may reduce their effort in high school (Rosenbaum 2004). Multidimensional attitudes toward education can also explain the paradox of high academic aspirations and weak academic performance (Mickelson 1990). One possible solution is to start a "college club" in 8th grade to build academic habits.³⁰ The club could provide a structured instructional format and peer support to engage students in understanding the connection between performance, GPA, and college opportunities. This type of intervention must be initiated early in a student's academic career to be effective. The senior year of high school is too late for improvements in student performance to make a meaningful difference in grade point average.

²⁹ For example, one counselor posted students' GPA next to the last few digits of each student's identification number in a school hallway. Next to the GPA list, she posted pie charts that showed if a student's GPA is within a certain numerical range, the student would likely be admitted to a selective college, if a student's GPA was within a lower range, the student would likely be admitted to a less selective college, etc. This strategy provided a clear and simple way of informing students where they stand in terms of their own academic performance and college admissions standards.

³⁰ I thank Frank Levy for this suggestion.

Consequences for Enrollment and Completion

The widespread desire to attend college reflects long-term efforts to raise aspirations for higher education, but this may not result in improved college outcomes, especially for low achieving students. First, students may not follow through with their college plans, e.g. by failing to complete their applications, finishing their applications but choosing not to send them, or deciding not to attend, despite stating strong interest in college (Avery and Kane 2004; Roderick et al. 2011). Second, even if students persist through all of the stages of the application process and gain admission, college is an expensive investment of time and money. Students must consider not only tuition costs but also the opportunity costs of foregone earnings (Becker 1993). Low achieving students may also experience a low rate of return on their college investment. In other words, some students may benefit more from entering the labor market or pursuing options other than college (Schmitt and Boushey 2012). ‘College for all’ may be a misguided strategy because many well-paying jobs do not require a college degree (Osterman 2008). Students with very low academic performance in high school who are nonetheless encouraged to attend college are not likely to complete a degree (NCES 2011). As a result, they could be left with large amounts of student debt without the earning power from a degree to easily pay it off.

One important question is why so many low income students interested in college have such low grades. Two obvious explanations are: 1) students attend low quality schools with ineffective teachers and limited classroom resources, or 2) students have lower academic ability than their classmates. The effects of either explanation are mediated by motivational qualities or tendencies. As the previous chapter shows, motivational qualities at an early age have a long lasting impact on future outcomes like the probability of earning a college degree, independent

of test scores and demographic characteristics. Students with external locus of control may feel their actions have little effect on their grades or their chances of going to college. Low levels of motivational qualities can translate into a passive approach to college admissions, which was revealed in the interviews and observations as students expected to attend college regardless of their grades. Many students were completing the required application steps without a full understanding of what going to, and succeeding in, college entails.

Limitations

There are a few study limitations to consider in interpreting the findings from this research. The interview sample consisted of a relatively small number of students attending low income schools in the Boston area, so the generalizability is limited. I attempt to mitigate this concern by including counselor anecdotes about other students and by supplementing the interviews with observations of over 120 students.

This study also focused on guidance counselors in urban public schools. Counselors working in schools that predominantly serve low income and minority students may have reduced expectations about their students' likelihood of gaining admission to college (Lopez 1996). These lower expectations could influence the amount of college information they offer, the content of the information, and the frequency with which they provide information (McDonough 1997; Corwin et al. 2004; Bryan et al. 2009). In addition, counselors at Boston schools might focus their advice on local postsecondary options because of the high concentration of higher education institutions in the city.

Finally, parents can play an influential role in their children's educational aspirations and access to college information. Parents who are more involved in their children's schools, e.g. by regularly attending parent-teacher meetings or speaking with guidance counselors, may increase

the amount of college information that students receive. I did not examine parents' level of involvement in the high school guidance counseling process.

VI. Conclusion

Low income students express strong interest in specific colleges, which indicates that they have general aspirations for postsecondary education and more specific expectations about attending particular colleges. High school counselors make a concerted effort to deliver to students factual information about colleges and procedural information about college applications. Non-profit organizations supplement and reinforce the college information awareness campaign. Students are familiar with college terminology and the application process, so lack of information in these areas is not a major barrier to college attainment. Many students displayed a good grasp of the steps involved in completing a college application even if they were not always initially successful. Overall, procedural knowledge was not a serious concern. Most students knew about differences in college type, the various application options they could use, the importance of standardized tests, and the availability of federal loans, so they could make informed decisions. Consequently, limited information about college options and the college application process does not harm college choices in my sample.

However, limited ability to process college information constrains students in pursuing their postsecondary goals. My research indicates students are missing fundamental knowledge and skills necessary to make productive use of college information. For some students, high school guidance sessions, college fairs and visits, and college search websites amount to a collection of disparate, disconnected facts. Students need to do more than simply gather and accumulate college data; they also need to operationalize this information. College-related information is being layered on to students who may lack the knowledge and skills to capitalize

on this newly acquired information. Students may see and receive the information, but they fail to correctly interpret it.

Even if students were able to process information correctly, college expectations do not align with students' academic performance in high school. This finding points to a larger problem that students are missing important skills. Schools must develop academic habits and effortful learning skills earlier if students are to be successful in the college application process during their senior year. In particular, they must instill the relationship between academic effort and grades. Without these habits, additional information about college will be too little too late.

Appendix

Comparison of Boston Public School District with Massachusetts

The Boston Public School system has lower rates of high school graduation and college entry, and higher proportions of low income and minority students than the rest of Massachusetts. According to state Department of Education data for the Boston Public School district, about 63% of students graduate from high school, 51% of graduates plan to enroll in four-year colleges (public or private), and 19% plan to enroll in two-year colleges. By comparison, Massachusetts overall has a much higher high school graduation rate (82%) and a larger proportion of students who plan to enroll in four-year colleges (60%) or two-year colleges (22%). Also, Boston Public School students come from more impoverished backgrounds: 74% are considered low income and 68% of students receive free lunch, compared to the 34% of students who are considered low income and the 29% who receive free lunch across the state. Finally, the Boston Public School district has higher concentrations of minority students: 36% of students are African American, 8% are Asian, and 41% are Hispanic. By comparison, the figures for all students in the state are 8% African American, 6% Asian, and 15% Hispanic (Mass DoE 2012).

Interview Instrument – Counselors / Advisors

Introduction

Hi, my name is Shomon, and I'm a researcher at MIT. I'm interested in how high school students think about college.

I'd like to ask you some questions about how students plan for college and how they think about the college admissions process. This interview should last about 30 minutes.

Interview Questions

How many years have you worked as a counselor?

What is the student-counselor ratio at your school?

Please describe the types of post-secondary counseling offered at your school, for example: group information sessions, one-on-one meetings, college fairs, college visits, etc.

- What topics are covered, for example: how to apply, essay writing, financial aid, etc?
- In what format do students receive this information (verbal description, college handbook, list of websites, etc) and how do they use it?

When do students in your school typically decide that they are going to college (fall of senior year, junior year, earlier)?

- What reasons do students give for deciding to go to college?

What kinds of information about college do students already have when they first see you?

- What kinds of questions do they ask you?

Which specific colleges are students interested in?

- How did they hear or learn about these colleges?
- How did they decide on these colleges?
- How far away from home do students typically go, or consider going, for college?

Do students' perceptions about their chances of admission to specific colleges match their grades, test scores, etc?

- Please describe any examples of students who had college expectations that were too high or too low, based on their academic record.

What proportion of students are 1st generation college students or undocumented students?

- What specific challenges do these groups pose and how do you address those challenges?

Have you noticed any trends in student expectations, college awareness, etc in your time as a counselor?

Please describe any student anecdotes that you found interesting or surprising related to college advising.

Wrap up

Is there anything else you want to share? Do you have any questions for me? Thank you very much for talking with me. Feel free to contact me if you have any comments or questions. My e-mail address is shomon@mit.edu.

Interview Instrument - Students

Introduction

Hi, my name is Shomon, and I'm a researcher at MIT. I'm interested in how high school students think about college. _____ [insert name of college counselor] suggested you'd be a good person to talk to.

I'd like to ask you some questions about how students plan for college and how they think about the college admissions process. This interview should last about 30 minutes.

I want to remind you that everything you say is completely confidential—no one at school or in your family will know what you say here. The only exception is that if you tell me that someone is hurting you, or that you are hurting someone, I have to tell someone about the situation. Before we start, do you have any questions for me? I want to hear about your ideas and experiences, so there are no right or wrong answers, OK?

Interview Questions

[Break the ice questions]

How is your school year going? What courses are you taking? What's your favorite class?

So you're a high school senior now, are you thinking of going to college?

If YES: When did you decide you were going to college?
 How did you decide you were going to college?

If NO: Why not?

For BOTH: What about your parents? Did they go to college?
 What about other family members (older brothers, sisters, aunts or uncles)? Did they go to college?
 What about your close friends? Do you know what they going to do after high school?
 What about other friends? What are they going to do after high school?
 Did your friends' plans influence your decision?

What are some of the colleges you're interested in?

How did you learn about these colleges?

How did you decide on the colleges you're interested in?

Probe: Do you know anyone who goes to these colleges?

Probe: Did you find out from friends, your parents, teachers, counselors?

What are your top 3 choices (in order)? Why?

Are you planning to apply to these colleges?

Probe: Do you know what you have to do to apply?

Probe: What are the steps to apply (common application, SATs, APs, essays, letters of recommendation, etc.)?

Have you visited these colleges? Do you plan to visit these colleges?

If you apply, what do you think your chances are of getting in to college X? (100%, 75%, 50%, etc.)

What makes you think you have a ___% chance of getting in to college X?

Do you know how many kids apply each year and get in to college X? (100%, 75%, 50%, etc.)

If you get in to college X, would you go? If you go to college X, what are the chances you will graduate? (100%, 75%, 50%, etc.) Why?

Do you have an idea of what you want to study?

Probe: Why are you interested in this subject?

What do you want to do after college?

How much money do you think you'll make in a year if:

- a) You finish high school and don't go to college?
- b) You go to college but don't finish?
- c) You go to college and graduate?

Wrap up

Is there anything else you want to share? Do you have any questions for me? Thank you very much for talking with me. Feel free to contact me if you have any comments or questions. My e-mail address is shomon@mit.edu.

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Selective Chances: Identifying the Causal Effect of College Selectivity on Bachelor's Degree Completion

Abstract

Low income students who pursue higher education predominantly attend less selective or nonselective colleges, where less than 50% of enrollees finish a degree. Scholars argue that students should enroll in higher quality colleges because they have higher graduation rates. However, if more able students choose to attend more selective colleges, then the higher graduation rates at these institutions may be due to incoming student characteristics, not college quality. Previous work contends with selection bias issues, focuses on earnings effects, and is limited to extremely selective private universities, overlooking both college graduation and the public institutions that serve most students. My research fills these gaps by identifying the causal impact of selective public universities on the probability of bachelor's degree completion. I use distance to the nearest selective public university as an instrumental variable for attendance to identify causal effects. Using the National Longitudinal Study of Youth 1997, I find that attendance at state flagships and other selective public colleges increases the probability of graduation, controlling for student grades and demographic characteristics. The effects of selectivity do not vary by family income, race, or gender. This research contributes to the literature by providing strong evidence on the causal effect of college selectivity on degree completion. In addition, I show the benefits of attending public universities, which account for the majority of students enrolled in four-year institutions. The findings suggest students should be encouraged to enroll in the most selective colleges they are qualified to attend. Students who undermatch by enrolling in less selective colleges than they are qualified for, may be harmed by attending these institutions.

Selective Chances: Identifying the Causal Effect of College Selectivity³¹ on Bachelor's Degree Completion

I. Introduction

Low income students who pursue postsecondary education often enroll in less selective colleges than students from wealthy families. Individuals from low socioeconomic status (SES) families are less likely to attend highly selective colleges and colleges that spend more per student, compared to high SES students (McPherson and Schapiro 2002; Hearn 1991; Davies and Guppy 1997; Hearn 1984). Further, the negative relationship between SES and selectivity of college attended has persisted since 1960 (Karen 1991; 2002). Sociologists have noted that the growing divide between low income and high income students within the same tiers of higher education is leading to horizontal stratification (Gerber and Cheung 2008).³²

Even academically qualified low income students attend less selective colleges, a phenomenon called undermatching (Roderick et al. 2008; Bowen et al. 2009; Dillon and Smith 2009). For example, over 60% of Chicago public school students enrolled in postsecondary institutions that are less selective than the colleges to which they likely would have been accepted based on their high school academic performance (Roderick et al. 2008). In North Carolina, more than 40% of highly qualified students (who have a combination of high school grades and standardized test scores that result in admission for 9 out of 10 applicants) do not attend the most selective state universities (Bowen et al. 2009). Nationwide, the majority of high-achieving, low income students who go to college attend institutions that are rated as less selective or nonselective (Wyner et al. 2009).

³¹ Throughout this paper, I use the terms 'quality' and 'selectivity' interchangeably. There are many different ways to assess college quality, including student-faculty ratio, tuition, and faculty salary (Black and Smith 2006; Long 2008). Selectivity, as measured by the academic qualifications of incoming students, is one widely accepted metric.

³² In contrast, vertical stratification refers to income segregation across levels of education, e.g. community colleges vs. four-year colleges.

Educators are concerned about rising enrollment in less selective colleges because these institutions typically have fewer resources to support successful student outcomes, in particular degree completion. At less selective four-year colleges, i.e. colleges that accept 75% or more of applicants, half of the students who enroll will not complete a degree (College Board 2011). On average, only one-in-four students will graduate if they attend four-year colleges with open admissions standards, where the graduation rate can dip as low as 8% (College Board 2011; Hess et al. 2009). The extremely low chances of graduating at less selective colleges prompted one analyst to label these institutions “failure factories” (Schneider 2008).

Previous research on the effects of college selectivity wrestles with selection bias problems, focuses on the impact of attendance on earnings, and is limited to a narrow slice of extremely selective private universities. Early work observes a strong association between selective college enrollment and positive financial and social outcomes (e.g. Bowen and Bok 1998). However, selective college attendance is endogenous. More (less) motivated students may choose to attend more (less) selective colleges, which could be driving the results. A long line of literature notes that students who attend more selective colleges go on to earn more money than those who attend less selective colleges (e.g. Weisbrod and Karpoff 1968; Brewer et al. 1999), but relatively few studies have examined the effects of attendance on college degree completion. Finally, almost all prior studies are confined to the most highly selective private universities that serve a small fraction of the postsecondary population.

My research fills these gaps by identifying the causal impact of selective public universities on the probability of bachelor’s degree completion. Using data from the National Longitudinal Study of Youth 1997, I find that attending a selective public college results in a 0.9 increase in the probability of completing a bachelor’s degree. The effects of selectivity are not

significantly different for subgroups based on family income, race, or gender. To address selection bias arising from students choosing to attend certain colleges, I employ instrumental variables estimation and use distance to the nearest selective public college as an instrument for college attendance. As a result, the estimates are interpretable as the causal effect of selectivity on graduation. The findings are robust to alternative specifications and estimation strategies.

This research contributes to the literature by providing strong evidence of the causal effect of college selectivity on degree completion. In addition, I show that the consistent positive effect applies to public universities, which account for the majority of all students enrolled in four-year institutions, including the majority of low income students. The findings suggest students wishing to earn a degree should be encouraged to apply to and enroll in the most selective colleges they are qualified to attend. These institutions improve individuals' chances of graduating from college, independent of student characteristics. Students who undermatch, i.e. their high school performance is well above the average of admitted students at the college attended, may have a lower chance of earning a degree by enrolling in less selective colleges.

Importance and Timeliness

This research has major policy implications because college choice influences individual and societal outcomes. A number of studies find that attendance at selective colleges is associated with higher future earnings (James et al. 1989; Loury and Garman 1995; Daniel et al. 1997; Bowen and Bok 1998; Brewer et al. 1999; Monks 2000; Zhang 2005; Hoekstra 2009; Andrews et al. 2012).³³ Further, the positive effect on wages of attending highly selective colleges has increased over time, from the 1970s to the 2000s (Brewer et al. 1999; Long 2010).

³³ Students who enroll in a highly selective college are also more likely to attend graduate school (Eide et al. 1998), which is associated with higher earnings.

The earnings effect is independent of individual endowments, as demonstrated in studies using twins (Behrman et al. 1996). Other work suggests that minority students and those students whose parents have low levels of education receive the biggest future earnings benefit from attending highly selective private institutions (Dale and Krueger 2011; 2002).

In addition, elite college attendance is associated with better individual outcomes that are important for society. Students who enroll in highly selective colleges exhibit better health characteristics after college, including physical functioning and perceived health (Ross and Mirowsky 1999). Selective college attendance is also correlated with reduced tobacco and marijuana use (Fletcher and Frisvold 2011).³⁴ Students who go to elite colleges are less likely to get divorced (Bowen and Bok 1998). College quality has positive effects on delay of marriage and childbearing; these effects have increased over the past 40 years (Long 2010).

Research on college selectivity and graduation is very timely due to increasing concerns about college affordability and the need for skilled workers. Over 75% of respondents in a nationwide survey believe college is too expensive for most Americans (Taylor et al. 2011). The largest increases in college tuition are concentrated at selective universities, where the cost of attendance exceeds 50% of median family income (Hoxby 1997; Ehrenberg 2000). But institutions and political leaders emphasize the need for increased college education to ensure economic competitiveness. Prominent philanthropic organizations, including the Gates Foundation and the Lumina Foundation, are now investing millions of dollars in college completion initiatives. President Obama and state governors recently called for adding 5 million college graduates to the nation's ranks so that the U.S. can regain its position as the most educated country in the world (White House 2009; NGA 2011). Understanding the effects of

³⁴ However, college selectivity has a small positive relationship with binge drinking (Fletcher and Frisvold 2011).

selectivity can help improve degree completion rates, produce a skilled workforce, and raise economic competitiveness.

The rest of this chapter proceeds as follows. In the next section, I present previous theoretical and empirical work on the educational effects of college quality and present my research questions. The following section describes the national data and quasi-experimental methods used in my analysis. Then, I present my findings and discuss the results. The final section concludes.

II. Theoretical and Empirical Work on College Quality

Economic and Sociological Theory

Theories in economics and sociology posit that the quality of the college attended can both directly and indirectly influence students' labor market and educational outcomes. Several theories predict that college selectivity has a positive effect on future earnings. The human capital model predicts this relationship on the basis of greater resources and investment. Higher quality colleges have better instructors and facilities, and spend more money on the educational process, which combine to increase student learning. As a result, students who attend high quality institutions build up more human capital than other students who attend low quality colleges. The increased human capital is rewarded with higher wages from employers in the labor market. A variant of the signaling model also predicts higher earnings due to selective college attendance, but the reasons are very different. According to this model, selective colleges do not necessarily perform a better job of educating students. Instead, attendance at an elite institution sends a signal to potential employers that the student possesses superior qualities by virtue of meeting stringent college admissions criteria. Consequently, employers will reward these students for perceived qualities, as opposed to the knowledge acquired at the high quality

college. Finally, social capital theory also predicts a positive relationship between college selectivity and earnings but on the basis of networks and stratification. Students who attend selective institutions may be introduced to a new set of social circles from which they were previously excluded. This exposure can enhance their social capital, defined as the networks, relationships, and connections in which social interactions are embedded. These relationships are important for gaining access to people in positions of power, like employers, particularly for high paying jobs.

College selectivity is also theorized to have an important effect on degree attainment but the sign is unclear *a priori*, i.e. the effect could be positive or negative. On the one hand, more selective colleges may have positive effects on student chances of graduation because these institutions have more resources and higher peer quality. An education production function approach suggests that better inputs will lead to better outputs. For example, greater financial resources may enable colleges to attract better teachers, provide more individualized attention by reducing student-faculty ratios, spend more on student instructional tools, provide more and better academic counseling support, and offer more financial aid so students need not hold a job while going to school (e.g. see Alon and Tienda 2005). Also, more selective colleges may surround students with more motivated peers, who help cultivate a strong academic culture that encourages success. High peer quality is also beneficial because an important component of learning during college occurs outside of the classroom (Winston 1999).

On the other hand, student chances of graduation may be harmed by attending selective colleges due to rigorous academic standards and social isolation. Intuitively, it should be harder to graduate from colleges with strict admissions criteria because these institutions demand more from their students. Selective colleges may establish a high bar for acceptable academic

performance, which makes it more difficult for students to succeed than if they attended institutions with lower passing standards. The potential negative effect of stringent academic criteria can be exacerbated if there is a serious mismatch between individual achievement and the average level of performance of other students (Alon and Tienda 2005). College mismatches can have the psychological effect of demoralizing students and lowering their self-esteem when they feel they do not measure up. Exclusive social circles at selective colleges can lead some students to feel socially isolated, which can harm the chances of degree completion (Tinto 1987). This isolation can be especially difficult for low income students attending elite private universities that have historically catered to wealthy families (Espenshade and Radford 2009). Finally, highly selective colleges may foster a hyper competitive academic culture that values individual achievement more than helping each other. Consequently, some students may fall behind their peers and never catch up.

To summarize, standard economic and sociological theories agree that college quality should have a positive relationship with future earnings but the impact on graduation is uncertain. High quality colleges may provide more resources to support student success. Or, the tough academic standards at selective colleges may make it more difficult for students to finish. Empirical research is needed to resolve this question.

Empirical Studies of Selectivity Effects

Empirical work in education and economics has begun to look more closely at the educational effects of selective college proximity and enrollment. Early research on the effects of education focused on years of schooling but even then scholars recognized the importance of

school quality (Weisbrod and Karpoff 1968).³⁵ Studies have examined the relationship between college selectivity, application, attendance, and degree completion.

Application

Research indicates that the presence of a selective college can influence students' interest in postsecondary institutions. Living close to a selective college shows a positive relationship with the quality of colleges to which students apply. Based on National Longitudinal Study of Youth 1997 (NLSY97) data, students are less likely to apply to a selective four-year college the farther away they live from this type of institution: an increase in distance of 75 miles (0.5 s.d.) is associated with a two percentage point decrease in the probability of application (Griffith and Rothstein 2009). Perhaps counter intuitively, low income students do not exhibit greater sensitivity to distance than similar high income students. The authors use a bivariate probit model with selection to account for two stages of the higher education decision process: 1) application to a four-year college, and 2) application to a selective vs. a non-selective four-year college. College selectivity is determined by *Barron's Guide* rankings of colleges as "most competitive" or "highly competitive." The major limitation of this work is that the analysis does not adequately control for students with certain characteristics choosing to attend more selective or less selective colleges.

Other research confirms the relationship between proximity and college applications using different data. Based on the National Education Longitudinal Study of 1988 (NELS88), students who live closer to more four-year colleges are more likely to apply to four-year colleges (Turley 2009). Proximity is measured using student commuting distance to college (12 miles for urban settings, 24 miles for suburban or rural areas). The average effect is small: each additional

³⁵ Weisbrod and Karpoff (1968) also highlighted the important effects on postsecondary earnings of unobserved individual characteristics like motivation and ambition, whose effects could be wrongly attributed to years of schooling. For more research on this topic, see the previous chapter of this dissertation.

college within commuting range is associated with a 1% increase in the odds of applying.

Although this study provides evidence on the importance of geography for college applications, there is a concern about omitted variables. In other words, the effects attributed to college proximity might actually be due to other variables that are correlated with proximity.

Attendance

Living near a selective college also appears to have a positive effect on the quality of colleges that students eventually attend.³⁶ More recent studies build on earlier work (Card 1993; Rouse 1995; Kling 2000; Currie and Moretti 2003) that used distance to the nearest college or the local concentration of colleges as instrumental variables and found that proximity to colleges increases attendance and years of education. Controlling for family income, parental education, and demographic variables, students who live closer to universities are far more likely to attend than students who live farther away (Frenette 2006). In the context of college quality, evidence from High School and Beyond 1980 data indicates that living near a top tier public university is associated with increases in the quality of college attended (0.27 standard deviations), but only for students from low socioeconomic status backgrounds (Do 2004). Living near a low tier university (public or private) is associated with decreases in the quality of college attended for low income students. In this study, college quality is measured using ratings from the Gourman Report. The results suggest that high quality colleges have positive spillover effects. These institutions may provide role models and information about postsecondary education to local residents.

Completion

³⁶ A recent study finds that distance to the nearest university also influences the choice of field of study (Denzler and Wolter 2011).

Relatively few studies have examined the relationship between college selectivity and degree completion, while controlling for the influence of confounding factors. Nearly all of these studies raise concerns about selection bias.

Initial work suggests that the effect of college selectivity on postsecondary degree completion depends on the match between observed student ability and institutional standards for academic performance. The probability of graduation rises with college quality as long as college quality closely aligns with student ability, as measured by scores on the Armed Forces Qualification Test (AFQT) (Light and Strayer 2000). In this context, college quality is measured by the median SAT of entering freshman and total expenditures per student. Although the probability of graduation rises with student AFQT scores at institutions in the top three quartiles of college quality, the relationship does not hold for bottom quartile colleges. Instead, higher ability students exhibit a lower chance of earning a degree if they attend a bottom quartile college. This finding suggests that institutional quality or peer effects can harm students, even if they have demonstrated strong ability. The primary concern with this work is that it is an observational study that does not adequately control for selection bias. As the authors note, unobserved variables affect the college attendance decision, which also affects the chances of college completion. In other words, the impact on graduation may be inaccurately attributed to college quality, instead of to differences in unobserved student variables.

Other work finds that college quality has a positive effect on bachelor's degree attainment, but these results are sensitive to the type of model used. Long (2008) conducts multiple analyses and compares the results of using ordinary least squares regression (OLS), instrumental variables estimation (IVE), selection on observables, and propensity score matching (PSM). Based on NELS88 data, the average SAT scores of incoming students have a positive

relationship with degree completion in the OLS ($\beta = 0.104, p < 0.01$), IVE ($\beta = 0.218, p < 0.05$), and PSM ($\beta = 0.104, p < 0.01$) models. The work examines several different measures of college quality: 1) median freshman SAT/ACT score, 2) average net tuition, 3) full professor salary, 4) faculty-student ratio, and 5) an index of the above measures. One limitation of this study is the choice of instrument: the average quality of colleges within a certain radius of the student's home is used as an instrument for the quality of college attended.³⁷ The same radius is used for all students despite large geographic differences between states and regions. Further, the radius used, 176 miles, is quite big especially for the large number of sample respondents who live in urban areas.³⁸

Recent work indicates that enrolling in a lower quality public university significantly reduces the chances of earning a degree (Cohodes and Goodman 2012). Further, the negative effect is attributed to high performing students who could have attended higher quality colleges. The authors use a regression discontinuity design based on a merit aid program that offers state college tuition waivers to students scoring above certain thresholds. As a result, the generalizability of the results is limited to Massachusetts.

Research examining the effects of college quality on degree completion for minority students yields mixed results. Conditional on college attendance, blacks and Hispanics are more likely to graduate than whites, controlling for demographics (age, gender), family characteristics (income, number of siblings, and mother's education), and local variables (unemployment rate and the proportion of residents who go to college) (Light and Strayer 2000). Minority students

³⁷ As Long (2008) explains, "Because there is a cost to the student of attending college far away from home, students are more likely to attend nearby. Nearby high-quality colleges lower the cost of obtaining a high-quality college education. Even if students do not care about quality, if they choose to attend a nearby college and if colleges nearby are high quality, they are more likely to attend a high-quality college by default" (592).

³⁸ For example, the instrument would imply that the existence of institutions like Georgetown University in Washington, DC would influence the college decisions of students in Allentown, PA and Trenton, NJ, which seems implausible.

in Texas appear to benefit from attending more selective colleges, thanks to the state's top 10% plan, which guarantees college admission to students finishing in the top decile of their high school class (Cortes and McFarlin 2008).

However, closer analysis indicates that college selectivity can have a negative effect on the probability of degree completion for minority groups. Based on National Longitudinal Study data of 1972, black students with low SAT scores are less likely to graduate if they attend more selective colleges, as opposed to less selective ones (Loury and Garman 1995). Within selective colleges, black students with low SAT scores have a lower probability of obtaining a degree than white students with similar scores (Loury and Garman 1995). The findings suggest that mismatches between low student test scores and high levels of selectivity can be harmful for minority students. Also, a recent study of the Texas plan uses a more robust local average treatment effect (LATE) framework and finds selectivity has negative effects on the probability of graduation for minority students (Furstenberg 2010).

Selection Bias Problem

The primary concern with most of these studies is that selective college attendance is endogenous. Students with certain characteristics may choose to enroll in more selective colleges, in which case the observed effects would be incorrectly attributed to college quality, instead of selection bias. Similarly, highly selective institutions may only admit students who possess certain unobserved characteristics that would lead to educational outcomes regardless of the college attended. In other words, these estimates of college quality are likely to be upwardly biased.

For example, assume that student motivation, which is unobserved, is the key factor that determines bachelor's degree completion. Consider the case where more motivated students

mostly enroll in selective colleges and less motivated students mostly enroll in non-selective colleges. In this situation, the graduation rate at selective colleges would be very high and at non-selective colleges it would be low. If we did not account for student motivation, we might incorrectly attribute the higher graduation rate to college selectivity.

My research uses quasi-experimental methods to directly address the selection bias problem confronting research on college quality. I answer the following research questions: *1) What is the causal effect of college selectivity on the probability of earning a degree? 2) Does the effect of selectivity on graduation vary by family income, race, or gender?* In contrast with previous studies, I examine the effects of selectivity at public universities. I focus on public institutions because they serve the vast majority (over 75%) of all students pursuing higher education (NCES 2012). Further, they serve the majority of low income students enrolled in college. By contrast, only 10% of students attending private highly selective universities come from low income backgrounds (Hill and Winston 2006).

III. Data and Method

Data

For this research, I use the National Longitudinal Survey of Youth 1997 (NLSY97), which is maintained by the U.S. Department of Labor. The survey consists of a nationally representative sample of 8,984 individuals born between 1980 and 1984. Households were randomly selected for participation in the survey. In addition to the cross-sectional sample of respondents, there is a supplemental sample of blacks and Hispanics who were surveyed in order to produce sample sizes for these groups that are large enough for statistical analysis. The dataset is more comprehensive than other surveys as it includes individuals who usually reside in the household but were away at school, hospitals, correctional facilities, or other institutions.

Individuals were first surveyed in 1997, when they were between the ages of 12 and 16. Follow up surveys were conducted on an annual basis thereafter. The most recent survey was conducted in 2010 when respondents were between 26 and 30 years old, i.e. beyond the age when most individuals who pursue postsecondary education have completed college. In 2010, 7,561 individuals participated in follow up interviews for a retention rate of 84%.

NLSY97 contains a wide range of information on schooling experience, including scores on standardized tests, type of degree received, and codes for postsecondary institutions attended. In addition, the dataset contains family background and demographic information, like mother's education, race, and gender.

Generalizability

The results of the analysis can be generalized to all people living in the United States, as represented by the National Longitudinal Survey of Youth cohort. The sample design adjusts for potential undercounting of racial and ethnic minorities, women, and low income groups. For NLSY97, this means the survey weighted findings apply to all individuals who were between 12 and 16 years old and living in the United States in 1997.

Methodology

For students attending college, degree completion will be a function of college qualities, attendance costs, individual student characteristics, and family background:

$$Y_{ij} = f(\mathbf{Q}_j, C_{ij}, \mathbf{X}_i, \mathbf{F}_i)$$

where for each individual i and college j , Y is an outcome like bachelor's degree attainment, \mathbf{Q} is a vector of college qualities like selectivity, C is the student's cost of attending a given college, \mathbf{X} is a vector of student characteristics, and \mathbf{F} is a vector of family characteristics.

A simple regression of graduation rates on college and student variables cannot distinguish between the effects of institutional factors and unobserved student characteristics. Academically qualified students who pursue postsecondary education often enroll in less selective colleges, which have fewer resources to support student success. However, the lower graduation rates attributed to these colleges could be due to the students who enroll there, i.e. selection bias.

The ideal experiment to measure the effect of selectivity would randomly assign qualified students to more selective or less selective colleges and then measure the difference in graduation rates. In the absence of this experiment, researchers must find exogenous variation that sorts similar ability students into different institutions.

A potential outcomes framework helps to explain the problem. Consider an experiment in which the treatment is attending a highly selective college and the control is attending a less selective college. Let Y_1 be the outcome for the treated state and Y_0 be the outcome in the control state. Let S be an indicator variable for the selectivity of the college attended, where $S = 1$ indicates attendance at a highly selective college and $S = 0$ indicates attendance at a less selective college. The outcome of interest is the effect on graduation of attending a highly selective college as opposed to a less selective college. This outcome is:

$$\Delta = E(Y_1 - Y_0 | S = 1)$$

We cannot observe Y_1 and Y_0 for the same individual so instead we use the difference in average outcomes across the sample:

$$\delta = E(\bar{y}_1 - \bar{y}_0 | S = 1)$$

Instrumental Variables Estimation

To isolate the causal effect of college selectivity on graduation, I employ instrumental variables estimation. I use residential distance to the nearest state flagship or other selective public university as a plausibly exogenous source of variation. This categorization adds several institutions to the 50 flagship universities for a total of 85 selective public universities (see Appendix A).

To be a valid instrument, the proposed variable must have a direct effect on student attendance at a selective college but not have any effect on degree completion, except through its effect on college attendance. I argue that distance to the nearest state flagship or other selective public university affects students on the margin of attending a selective institution. As noted above, previous research has used proximity to college as an instrumental variable and shown it is a valid instrument for general college application and attendance (e.g. Card 1993; Rouse 1995; Turley 2009). In addition, other work has used distance to selective colleges as an instrumental variable and also shown it is a valid instrument for application to and attendance at selective colleges (e.g. Do 2004; Frenette 2006; Griffith and Rothstein 2009). I apply the distance instrumental variable to the study of college quality, using selectivity as a proxy for quality.

The intuition is that students who live closer to the state flagship or other selective public university will be more likely to enroll there because of: 1) increased awareness, 2) lower financial costs, 3) lower psychological costs, and 4) social ties. First, the simple presence of nearby colleges can passively communicate information about higher education to both students and families (Perna 2010, 159; Leppel 1994; McDonough et al. 1997). The geographic proximity of a college to an individual's residence may signal increased access to information about the college and heightened familiarity with the college among family, friends, and neighbors (Perna 2010; Leppel 1994; McDonough et al. 1997). Further, selective public

universities often play prominent social, community engagement, and economic development roles in their regions, so students are more likely to hear about them (Do 2004). As a result, students who live closer to a selective university are more likely to attend because of increased exposure and the ease of visiting. Second, individuals are more likely to attend nearby colleges because the option to live at home reduces costs as students do not have to pay for room, board, and moving costs (Card 1993; Rouse 1995). Even if they decide to live on campus, students may still choose to attend nearby colleges because it is cheaper to travel home during holidays and vacations. Also, the lower tuition rate charged for in-state residents can make nearby public universities a more attractive option for higher education than private or out-of-state public institutions (Kane 2007). Third, students may simply desire to attend college closer to home because they are more comfortable and familiar with the city, area, or state. Fourth, attending a nearby college makes it easier to maintain family relationships and provide care for siblings, grandparents, or other relatives. Proximity to college can be important for students who have family or work responsibilities, desire to keep close ties with family or friends, or need to get home quickly in the event of emergencies (NCES 1998).

The key identifying assumption is that student ability does not systematically vary based on relative distance to the state flagship or other selective public university. By comparing students who are similar, on average, except for their likelihood of attending the state flagship or other selective public university, I can isolate the causal effect of selectivity.

The distance instrument captures the effect of college selectivity based on students who are less likely to attend faraway colleges. Students whose decisions are most affected by distance may possess other qualities that negatively affect degree completion. For example, students may stay closer to home because they have a job, provide care for siblings, or fulfill

other family responsibilities that make it more difficult to finish college. In this case, my results will underestimate (overestimate) the positive (negative) effects of college selectivity on degree completion. The findings should be interpreted as applying to students whose college choices are sensitive to distance to the state flagship or other selective public university.

Variables

The primary outcome of interest (dependent variable) is college completion, which is defined as earning a bachelor's degree within four to eight years of initial enrollment. About 75% of students who earned a bachelor's degree completed it within eight years; expanding the window beyond this period has only a modest effect on completion rates at public universities (NCES 2011). I create a dichotomous variable for obtaining a bachelor's degree (or higher) based on self-reported data on students' educational experiences.

The main independent variable is attendance at a state flagship or other selective public university. State flagships are typically the most selective, most prominent, and the largest public four-year postsecondary education institutions in each state. Well known examples include University of Virginia, University of Michigan, and University of North Carolina. I categorize other public universities as selective if the average SAT or ACT scores of incoming students at the 75th and 25th percentiles are in the top quartile of all public universities. This categorization expands the list to include institutions like UCLA, William and Mary, and Georgia Tech.

Selective college enrollment may be correlated with ability or other unobserved qualities that affect degree completion, so I use geographic distance between the student and the nearest state flagship or other selective public university as an instrumental variable for attendance at these institutions.

To determine distances, I use ArcGIS mapping software to plot students' residential location during high school, i.e. prior to college entry. The restricted-use NLSY97 dataset provides respondent geographic location information at the state, metropolitan statistical area (MSA), and county levels. Some respondents live in rural areas or otherwise have missing MSA information, so I use counties to identify geographic location. I calculate the longitude and latitude of the centroid of each county of residence and use this point as the respondent's location.

Then, I use ArcGIS mapping software to plot the locations of state flagship and other selective public universities. The Integrated Postsecondary Education Data System (IPEDS) Data Center, maintained by the National Center for Education Statistics, provides street address, longitude, and latitude information for all accredited postsecondary institutions, including the colleges in this study. I calculate the geographic distance in meters between the student's location and the location of the nearest university based on longitude and latitude coordinates. I use a log function to transform the distance measurement in order to create a distribution that more closely approximates a normal distribution.

Individual characteristics can influence the likelihood of completing a bachelor's degree, so I attempt to control for these differences using the rich set of variables in the NLSY97 data. Students who enroll in selective universities likely possess stronger academic records than their peers attending less selective colleges. To account for individual differences in academic performance and ability, I include control variables for student grade point average in high school and Armed Services Vocational Aptitude Battery (ASVAB) scores. In addition, I control for family and demographic characteristics, like mother's education, race, and gender. Local variation in the quality of primary, secondary, and tertiary education could also affect student

graduation outcomes. For example, students in areas with strong high schools might have higher graduation rates, regardless of the college they attend. I use clustered standard errors to account for these local effects.

Estimation Strategy

Given that degree completion is a binary outcome, non-linear models like logit or probit models are the preferred estimation strategy. However, neither of these models easily lends itself to modeling by instrumental variables estimation. For probit models, instrumental variables estimation is possible if the endogenous regressor is a continuous variable. That condition does not hold in this study because selective college attendance is a dichotomous variable. For logit models, reliable instrumental variables estimations have not been developed. In other models (e.g. probit and tobit), maximum likelihood estimators assume joint normal distribution for the error term of the endogenous regressor in the structural and reduced-form equations. It is unclear how one would determine the appropriate bivariate distribution to use for the error terms in an instrumental variables estimation logit model (Poi 2006).

Linear probability models can be used for binary outcomes and instrumental variables estimation. Estimations from linear probability models are similar to those from probit and logit models with the added benefit of straightforward interpretation (Angrist and Pishke 2008). Further, linear probability models can be used with instrumental variables estimations when endogenous regressors are dichotomous or count data (Baum 2007). In the analysis that follows, I primarily use linear probability models. Given that these are linear estimations of non-linear functions, I emphasize direction (positive vs. negative) and statistical significance instead of the magnitude of the coefficients in interpreting the results. I also show the results from alternative estimation strategies.

Statistical Model

I estimate the following models using Two-Stage-Least-Squares (2SLS) regression analysis. The first stage uses distance from a respondent's location to the nearest state flagship or other selective public university as an instrumental variable for college attendance. The first stage model is:

$$\text{ATTEND}_i = \alpha_0 + \alpha_1 \text{DIST}_i + \alpha_2 \text{GPA}_i + \alpha_3 \text{ASVAB}_i + \alpha_4 \mathbf{X}_i + \varepsilon_i \quad (1)$$

where for each individual i , ATTEND is attendance at a state flagship or other selective public college; DIST is the log distance to the nearest selective public university from the centroid of the respondent's county of residence (before she or he entered college); GPA is student high school grade point average; ASVAB is the respondent's score on the Armed Services Vocational Aptitude Battery; \mathbf{X} is a vector of family background and demographic characteristics, including mother's education, the level of urbanization in the resident's location, race, and gender; and ε is a random error term.

The second stage uses the predicted attendance from the first stage to determine the impact of selective college attendance on students' probability of graduating. The second stage model is:

$$\text{BA}_i = \beta_0 + \beta_1 \text{ATTENDhat}_i + \beta_2 \text{GPA}_i + \beta_3 \text{ASVAB}_i + \beta_4 \mathbf{X}_i + v_i \quad (2)$$

where for each individual i , BA is whether or not a student obtained a bachelor's degree or higher; ATTENDhat is the predicted attendance from the equation above; and v is a random error term. (All other terms are the same as in the equation above.) The coefficient of interest is β_1 . A positive, statistically significant value will indicate that attending a selective public college increases the probability that a student earns a bachelor's degree.

IV. Findings and Discussion

Descriptive Statistics

Descriptive statistics for postsecondary education enrollees in the NLSY97 cross-sectional sample ($n = 4532$) show that over one-half of students enrolled in four-year institutions. Nearly 80% of students attended public colleges or universities and a similar proportion enrolled in institutions in their state of residence. In other words, the vast majority of students who pursue postsecondary education enroll in nearby public institutions (see Table 1).

Over one-third of respondents earn at least a bachelor's degree; nearly one-half earn an associate's degree or higher. Almost 10% of respondents attended a state flagship or other selective public university. Note that the dataset includes college admissions test score information (self-reported SAT or ACT scores) for less than half of the sample of college enrollees. I do not include standardized test scores in the models presented below because they would sharply reduce the sample size. SAT and ACT scores are highly correlated with high school GPA and ASVAB scores, which are included in the models. More than half of postsecondary enrollees are female; over 70% are white. Mothers of respondents who enrolled in postsecondary education have completed an average of 1.5 years of schooling past high school. The survey weighted descriptive statistics reveal similar figures (see Table 2).

Correlations

Correlation tables provide preliminary evidence of the basic relationships between degree completion and other variables, including the positive relationship between selective public university attendance and the probability of earning a bachelor's degree (see Tables 3 and 4). Of all the variables considered, high school GPA has the highest correlation ($r = 0.42$) with bachelor's degree completion, as expected. Students who demonstrate strong academic performance in secondary school are more likely to succeed in postsecondary education. For

students who pursue higher education, attendance at state flagships ($r = 0.21$) and other selective public universities ($r = 0.26$) has a small to moderate positive correlation with bachelor's degree completion.³⁹ In other words, enrolling in selective public institutions is associated with earning a degree. Of course selective college attendance is associated with many other factors that may affect degree completion, so we need to disentangle the influence of these other variables.

Regression Estimates

Regression results show that attendance at a selective public university has a positive, statistically significant effect on the probability of earning a bachelor's degree, controlling for other variables (see Table 5). Model 1 shows that attendance has a strong relationship with degree completion ($\beta = 0.343, p < 0.001$), when holding constant mother's education, race, gender, and the level of urbanization. As noted earlier, student high school performance is also an important factor affecting postsecondary degree attainment; it has an independent positive effect (see Model 2). The addition of high school GPA to the model reduces the coefficient on attendance, but it remains positive and statistically significant ($\beta = 0.236, p < 0.001$). Similarly, the inclusion of ASVAB scores as another measure of student ability also reduces the coefficient on attendance, but it remains positive and statistically significant ($\beta = 0.199, p < 0.001$). In other words, attendance at a selective public college is associated with a 0.2 increase in the probability of finishing a bachelor's degree. The positive effect of selective college attendance on bachelor's degree completion is consistent across linear probability, probit, and logit models for both unweighted and survey weighted estimations (see Tables 6 and 7).

³⁹ Note that public college attendance has a small negative correlation with degree completion, likely due to the large proportion of students who attend two-year community colleges and do not intend to earn a degree.

However, these estimates likely overestimate the impact of college selectivity on bachelor's degree completion because of selection bias. Selective colleges choose to admit certain applicants who may differ from other students in ways that affect the chances of earning a degree. For example, admissions officers at selective colleges may look beyond grades and standardized test scores to place more weight on behavioral qualities, like motivation and persistence, that are revealed through personal statements, reference letters, and extracurricular activities. Similarly, certain types of students apply to and choose to enroll in selective colleges. If students who enroll in selective colleges are more motivated or persistent than other students, then these regression estimates will be biased. We would incorrectly attribute the effects of individual student behavioral qualities to the effects of attending a selective college. So we need some way of comparing students who are similar on observed and unobserved characteristics, except for the type of college they attend.

Basic correlations provide preliminary support for using distance to the nearest selectivity public university as an instrument for selective public university attendance (see Tables 8 and 9).⁴⁰ For distance to be a valid instrument, it must be correlated with selective public university attendance but uncorrelated with other factors that affect college graduation. Log distance displays a small, negative correlation with attendance at a state flagship or selective public university, as hypothesized. Students who live farther away from selective public universities are less likely to enroll in these institutions. So the first condition has been met: distance is (negatively) correlated with attendance. The second condition for a valid instrument requires that distance is not correlated with other variables that influence degree completion. The tables show that students who live farther away from selective colleges do not appear to systematically

⁴⁰ Among respondents, average distance to the nearest selective public university is approximately 100 km, or about 62 miles.

vary from students who live closer, with respect to important observed variables that affect the chances of earning a degree. For example, students who live farther away from selective public colleges are essentially equally likely to attend four-year colleges as students who live closer to these institutions. Log distance also shows insubstantial correlations with high school GPA, mother's education, gender, and race, so it appears that distance is independent of these qualities that impact the probability of earning a degree.

Additional evidence for the validity of the instrument comes from a comparison with endogenous variables. I estimate a regression that predicts selective public university attendance, controlling for log distance, high school GPA, mother's education, the level of urbanization, race, and gender. I save the residuals from this estimation to compare them with the distance instrument. For distance to be a valid instrument, it must also be uncorrelated with "back door" variables that affect degree completion, i.e. other variables that are not included in the model. These variables are absorbed in the residual. Correlations show that log distance has a trivial, near zero correlation with the residuals from the attendance regression model (see Table 10). These results provide further support for using distance as an instrument.

Instrumental variables estimates show that selective public universities have a positive causal effect (weighted: $\beta = 0.903$, unweighted: $\beta = 0.947$) on bachelor's degree completion (see Tables 11 and 12). In other words, a student who attended a public selective college has a 0.9 increase in the probability of completing a bachelor's degree, compared to a student who does not attend this type of institution. This effect is statistically significant at the $p < 0.01$ level for both unweighted and survey weighted models. The coefficients in these IV models are much higher than in the simple biased linear probability models. The magnitude of the coefficients is likely inflated by a combination of the two-stage framework and linear model assumptions

applied to a binary outcome, so these coefficients should be understood as upper-bound estimates. The coefficients on the other variables in the IV model are quite similar to the coefficients in the simple regression (biased) model, in terms of size, direction, and statistical significance. This consistency provides further support for the results. Finally, note that the F statistic for the instrumental variable is greater than 16 in the two stage least squares models and about 30 in the ivreg2 models. These values exceed the threshold of 10 recommended for a variable to be considered a valid instrument (Bound et al. 1995).

I do not find important differences in the effects of college selectivity on various student subpopulations. If I split the sample into students above and below median family income, the coefficients on selective public university attendance are no longer statistically significant. Similarly, comparisons of men vs. women and whites vs. non-whites do not reveal a statistically significant effect of selective public university attendance. The absence of any significant impact on these subpopulations could be due to the smaller sample sizes.

The results indicate that enrolling in a selective public university increases the chances of earning a degree, independent of students selecting into different institutions based on unobserved variables. The instrumental variables estimates can be interpreted as the causal effect of college selectivity on degree completion.

These findings suggest that students who wish to complete a bachelor's degree should be encouraged to enroll in the most selective public universities that they are qualified to attend. Many students who pursue postsecondary education often enroll in less selective or non-selective colleges for a variety of reasons, including concerns that the high academic standards at selective institutions will make it difficult to succeed. Indeed, low income students are more likely to attend less selective institutions, even controlling for academic performance (Wyner et al. 2009).

The growing evidence on undermatching (Bowen et al. 2009; Roderick et al. 2008) has raised concerns among educators that students are setting their college sights too low. But without randomly assigning people to attend colleges with different levels of selectivity, it is difficult to know if students would benefit from selective college enrollment. This research provides strong evidence that selective public college attendance has a positive causal effect on the probability of earning a degree.

Disseminating information about the benefits of selective public university attendance should also become an important component of the college guidance process. As noted in the previous chapter, student information about specific colleges can be inconsistent and individual decisions about where to apply are often haphazard. Increased information about degree completion rates at various colleges could help improve student application and enrollment decisions.

One question that arises from the findings is what aspect of selective public universities is driving the higher probability of completing a degree. Private universities have extremely large endowments that enable them to spend tens of thousands of dollars per student (Upton and Schnaars 2012; Hopkins 2011). Indeed, the cost of educating students at private institutions even exceeds the extremely high tuition prices (Winston 1999). Further, the gap in spending between private and public universities has risen over the past decade (Desrochers and Wellman 2011). But the results of my analysis show benefits from attendance at public universities, so the effects are less likely due to financial resources. The selectivity measures are based on SAT and ACT scores of incoming students, which suggests that peer environment plays an important role in the positive effects. Enrolling in a university with high achieving classmates may have strong positive spillover effects on the probability of degree completion. This could be due to high

performing students who fuel a strong academic culture that values and supports success in college. Of course, this measure of selectivity may be correlated with other college characteristics that influence degree completion, including faculty quality and course offerings.

Threats to Validity

The primary threat to validity is that individual residential location is not randomly assigned with respect to state flagship and other selective public university locations. Families choose to live in certain areas based on local amenities, which may include the presence of a high quality public institution of higher education. If families with a greater taste for sending their children to selective colleges choose to live closer to selective colleges, then college proximity and college selectivity will be endogenous.

Similarly, individuals who live farther away from state flagships and other selective public universities may differ in some unobservable ways that affect the probability of degree completion. For example, students who live at greater distances from selective institutions may have lower levels of academic motivation, which would reduce their chances of graduating from college. In this case, we might incorrectly attribute the effects of individual behavior or personality differences on college selectivity. Of course, unobservable differences are, by definition, beyond measurement. However, NLSY97 does contain some information that can be used to address this potential threat to validity. The survey included questions about whether respondents were organized, dependable, agreeable, cooperative, flexible, conscientious, thorough, and trustful.⁴¹ Table 13 shows that the correlation between these traits and log

⁴¹ The survey language is: "Please use this list of common human traits to describe yourself as accurately as possible. Describe yourself as you see yourself at the present time, not as you wish you might be in the future. Describe yourself as you are generally or typically, as compared with other persons you know of the same sex and of roughly the same age. How much do you feel that disorganized describes you as a person?...." All questions were rated on a scale of one to five.

distance is very close to zero. In other words, students who live farther away from selective public universities do not systematically differ on these behavioral qualities from students who live closer.

As their children reach college age, families who put a high value on college education may strategically move closer to state flagship and other selective public universities. This is unlikely given that families enjoy the benefits of in-state tuition subsidies regardless of where they live relative to the public university, as long as they maintain state residency. In any case, I limit the influence of strategic moves by using respondent's residential location when they were as young as 12 years old. At such an early age, it is unlikely that parents would move in anticipation of potential college attendance at a nearby selective public institution.

A different potential threat to validity is that proximity to selective colleges may affect student outcomes even if they do not enroll in these colleges. For example, college density could affect the local supply and demand for labor, which would influence the wages of college students who are employed in the area. However, the concentration of colleges should not affect the results of this study. Individual degree completion is specific to the institution that a student attends, so this outcome should not be affected by the presence of other colleges.

V. Conclusion

In higher education, low income students are more likely to attend less selective colleges than students from wealthy families, even controlling for prior academic performance. The phenomenon of undermatching, i.e. low income students enrolling in less selective colleges than they are qualified to attend, has raised concerns among educators because these institutions exhibit extremely low graduation rates. Previous research examining the effects of college selectivity on degree completion is limited to a small number of extremely selective private

universities that serve very few students. My research determines the causal effect of selectivity at public universities, which account for the majority of postsecondary students, including low income students. I employ instrumental variables estimation and use distance to the nearest selective public college as an instrument for college attendance to identify causal effects. Using data from the National Longitudinal Study of Youth 1997, I find that college selectivity increases the probability of completing a bachelor's degree, controlling for academic performance, family background, and demographic characteristics. The findings have important implications for college counseling and student decisions: students wishing to earn a degree should be encouraged to apply to and enroll in the most selective colleges they are qualified to attend.

Tables

Table 1

Unweighted descriptive statistics (means and standard deviations) for cross-sectional sample of NLSY97 respondents who enrolled in postsecondary education

Variable	Number of Observations	Mean	Standard Deviation
BA degree or higher	4524	0.375	0.484
AA degree or higher	4524	0.471	0.499
Attend four year	4366	0.545	0.498
Attend two year	4366	0.445	0.497
Attend flagship	4465	0.065	0.247
Attend selective public	4465	0.094	0.292
Attend in state	4532	0.777	0.416
Attend public	4408	0.797	0.402
Attend private	4408	0.142	0.349
Distance to college	4532	100368	87244
SAT math	1838	546	113
SAT verbal	1820	543	108
ACT composite	1543	22.7	4.9
High school GPA	4373	3.05	0.74
ASVAB	3809	58.57	26.68
Mother's Education	4262	13.43	2.66
Urban	4363	0.732	0.443
Male	4532	0.476	0.499
White	4532	0.722	0.448

Table 2

Survey weighted descriptive statistics (means and linearized standard errors) for NLSY respondents who enrolled in postsecondary education (n=4,887)

Variable	Mean	Linearized Standard Error
BA degree or higher	0.397	0.013
AA degree or higher	0.493	0.011
Attend four year	0.558	0.019
Attend two year	0.432	0.019
Attend flagship	0.066	0.006
Attend selective public	0.098	0.008
Attend in state	0.799	0.014
Attend public	0.791	0.012
Attend private	0.149	0.011
Distance to college	100050	8902
High school GPA	3.070	0.017
Mother's Education	13.47	0.09
Urban	0.727	0.027
Male	0.478	0.007
White	0.743	0.018

Note: Calculations based on NLSY survey weights

Table 3

Correlation matrix of selected variables for NLSY respondents who enrolled in postsecondary education

	BA or higher	AA or higher	Attend flagship	Attend selective public	HS GPA	Mother's Ed.	Urban	Male	White
BA or higher	1.00								
AA or higher	0.82	1.00							
Atnd flagship	0.21	0.16	1.00						
Atnd sel. pub.	0.26	0.21	0.66	1.00					
HS GPA	0.42	0.38	0.18	0.22	1.00				
Mother's Ed.	0.28	0.23	0.13	0.16	0.18	1.00			
Urban	0.01	-0.03	0.02	0.02	-0.08	0.02	1.00		
Male	-0.07	-0.08	0.00	0.03	-0.18	0.05	0.01	1.00	
White	0.17	0.17	0.09	0.11	0.22	0.24	-0.17	0.04	1.00

Table 4

Correlation matrix of college-type variables for NLSY respondents who enrolled in postsecondary education

	BA or higher	AA or higher	Attend four year	Attend two year	Attend public	Attend private	Attend in state
BA degree or higher	1.00						
AA degree or higher	0.82	1.00					
Attend four year	0.44	0.34	1.00				
Attend two year	-0.43	-0.32	-0.98	1.00			
Public	-0.10	-0.09	-0.32	0.34	1.00		
Private	0.24	0.19	0.36	-0.36	-0.81	1.00	
Attend in state	-0.05	-0.04	-0.19	0.19	0.30	-0.26	1.00

Table 5

Parameter estimates and approximate p-values for unweighted linear probability models describing the relationship between selective public college attendance and the probability of completing a bachelor's degree, for students who enrolled in postsecondary education, controlling for grade point average, ASVAB score, mother's education, living in an urban area, gender, and race.

	Earn bachelor's degree				
	(1)	(2)	(3)	(4)	(5)
Attend sel. pub.	0.343*** (0.025)		0.236*** (0.025)		0.199*** (0.025)
High school GPA		0.242*** (0.009)	0.223*** (0.010)	0.190*** (0.011)	0.180*** (0.011)
ASVAB				0.004*** (0.000)	0.004*** (0.000)
Mother's Education	0.042*** (0.003)	0.036*** (0.003)	0.034*** (0.003)	0.029*** (0.003)	0.027*** (0.003)
Urban	0.01 (0.019)	0.041* (0.018)	0.03 (0.018)	0.03 (0.019)	0.021 (0.018)
Male	-0.099*** (0.012)	-0.030* (0.013)	-0.039** (0.013)	-0.042** (0.016)	-0.051*** (0.015)
White	0.105*** (0.021)	0.058** (0.018)	0.047** (0.017)	-0.006 (0.018)	-0.01 (0.017)
Constant	-0.248*** (0.043)	-0.894*** (0.044)	-0.804*** (0.042)	-0.814*** (0.043)	-0.743*** (0.043)
N	4035	3951	3893	3343	3296

Clustered standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 6

Comparison of unweighted parameter estimates and approximate p-values for linear probability, probit, and logit models describing the relationship between selective public college attendance and the probability of completing a bachelor's degree, for students who enrolled in postsecondary education, controlling for grade point average, ASVAB score, mother's education, living in an urban area, gender, and race.

	Earn bachelor's degree		
	LPM	Probit	Logit
Attend sel. pub.	0.199*** (0.025)	0.576*** (0.091)	0.978*** (0.161)
High school GPA	0.180*** (0.011)	0.626*** (0.044)	1.060*** (0.075)
ASVAB	0.004*** (0.000)	0.012*** (0.001)	0.020*** (0.002)
Mother's Education	0.027*** (0.003)	0.090*** (0.011)	0.155*** (0.020)
Urban	0.021 (0.018)	0.057 (0.060)	0.099 (0.103)
Male	-0.051*** (0.015)	-0.164** (0.050)	-0.272** (0.084)
White	-0.01 (0.017)	-0.019 (0.060)	-0.031 (0.103)
Constant	-0.743*** (0.043)	-4.173*** (0.192)	-7.116*** (0.350)
N	3296	3296	3296

Clustered standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 7

Comparison of survey weighted parameter estimates and approximate p-values for linear probability, probit, and logit models describing the relationship between selective public college attendance and the probability of completing a bachelor's degree, for students who enrolled in postsecondary education, controlling for grade point average, ASVAB score, mother's education, living in an urban area, gender, and race.

	Earn bachelor's degree		
	LPM	Probit	Logit
Attend sel. pub.	0.190*** (0.025)	0.558*** (0.090)	0.946*** (0.158)
High school GPA	0.184*** (0.012)	0.627*** (0.046)	1.062*** (0.080)
ASVAB	0.004*** (0.000)	0.012*** (0.001)	0.021*** (0.002)
Mother's Education	0.028*** (0.003)	0.092*** (0.012)	0.158*** (0.021)
Urban	0.017 (0.019)	0.045 (0.063)	0.079 (0.108)
Male	-0.049** (0.016)	-0.160** (0.052)	-0.263** (0.088)
White	-0.009 (0.018)	-0.013 (0.065)	-0.024 (0.111)
Constant	-0.779*** (0.045)	-4.243*** (0.204)	-7.221*** (0.375)
N	3296	3296	3296

Clustered standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 8

Correlation matrix of distance and attendance for NLSY respondents who enrolled in postsecondary education

	Log Distance	Attend Four Year	Attend flagship	Attend selective public
Log distance	1.00			
Attend four year	-0.01	1.00		
Attend flagship	-0.04	0.24	1.00	
Attend sel. pub.	-0.10	0.30	0.66	1.00

Table 9

Correlation matrix of distance and background variables for NLSY respondents who enrolled in postsecondary education

	Log Distance	HS GPA	Mother's Ed.	Urban	Male	White
Log distance	1.00					
High school GPA	0.02	1.00				
Mother's Education	-0.02	0.18	1.00			
Urban	-0.12	-0.08	0.02	1.00		
Male	-0.02	-0.18	0.05	0.01	1.00	
White	0.04	0.22	0.24	-0.17	0.04	1.00

Table 10

Correlation matrix of instrumental variable and endogenous variables for NLSY respondents who enrolled in postsecondary education

	Log distance	Attend flagship	Residuals
Log distance	1.00		
Attend flagship	-0.09	1.00	
Residuals	-0.03	0.00	1.00

Table 11 [iv regress 2sls]

Unweighted and weighted parameter estimates and approximate p-values for instrumental variable linear probability models describing the relationship between selective public college attendance and the probability of completing a bachelor's degree, for students who enrolled in postsecondary education, controlling for grade point average, ASVAB score, mother's education, living in an urban area, gender, and race. The probability of enrolling in a selective college is endogenous, so log distance to the nearest selective public college is used as an instrument for attendance.

	Earn bachelor's degree	
	Unweighted	Weighted
Attend sel. pub.	0.903** (0.343)	0.947** (0.352)
High school GPA	0.140*** (0.025)	0.137*** (0.028)
ASVAB	0.002** (0.001)	0.002** (0.001)
Mother's Education	0.021*** (0.004)	0.021*** (0.005)
Urban	-0.003 (0.022)	-0.009 (0.024)
Male	-0.071*** (0.017)	-0.076*** (0.020)
White	-0.012 (0.018)	-0.012 (0.020)
Constant	-0.498*** (0.129)	-0.486** (0.148)
<i>F</i> -statistic	16.05	16.98
N	3296	3296

Clustered standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 12 [ivreg2]

Unweighted and weighted parameter estimates and approximate p-values for instrumental variable linear probability models describing the relationship between selective public college attendance and the probability of completing a bachelor's degree, for students who enrolled in postsecondary education, controlling for grade point average, ASVAB score, mother's education, living in an urban area, gender, and race. The probability of enrolling in a selective college is endogenous, so log distance to the nearest selective public college is used as an instrument for attendance.

	Earn bachelor's degree	
	Unweighted	Weighted
Attend sel. pub.	0.903** (0.283)	0.947*** (0.284)
High school GPA	0.140*** (0.020)	0.137*** (0.021)
ASVAB	0.002*** (0.001)	0.002*** (0.001)
Mother's Education	0.021*** (0.004)	0.021*** (0.005)
Urban	-0.003 (0.021)	-0.009 (0.021)
Male	-0.071*** (0.019)	-0.076*** (0.020)
White	-0.012 (0.020)	-0.012 (0.021)
Constant	-0.498*** (0.112)	-0.486*** (0.120)
<i>F</i> -statistic	33.09	28.91
N	3296	3296

Clustered standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 13

Correlation matrix of instrumental variable and behavioral qualities for NLSY respondents who enrolled in postsecondary education

	Log Dist.	Organ- ized	Depend- able	Agree- able	Coop- erative	Flex- ible	Con- scien- tious	Tho- rough	Trust- ful
Log distance	1.00								
Organized	0.02	1.00							
Dependable	0.03	0.25	1.00						
Agreeable	0.02	0.10	0.12	1.00					
Cooperative	0.00	0.21	0.21	0.39	1.00				
Flexible	-0.02	0.16	0.09	0.27	0.44	1.00			
Conscientious	-0.02	-0.03	0.10	0.14	0.09	-0.02	1.00		
Thorough	0.02	0.24	0.26	0.29	0.20	0.09	0.22	1.00	
Trustful	0.01	0.10	0.21	0.25	0.20	0.08	0.15	0.26	1.00

Appendix

List of state flagship and other selective public universities

Note: other public universities are categorized as selective if the SAT or ACT scores of incoming students in the 25th and 75th percentiles are in the top quartile for all public universities.

<u>Name</u>	<u>City</u>	<u>State</u>
Auburn University	Auburn	AL
California Polytechnic State University-San Luis Obispo	San Luis Obispo	CA
Christopher Newport University	Newport News	VA
Clemson University	Clemson	SC
College of Charleston	Charleston	SC
College of William and Mary	Williamsburg	VA
Colorado School of Mines	Golden	CO
Eastern Washington University	Cheney	WA
Florida State University	Tallahassee	FL
Georgia Institute of Technology-Main Campus	Atlanta	GA
Indiana University-Bloomington	Bloomington	IN
Iowa State University	Ames	IA
James Madison University	Harrisonburg	VA
Louisiana State University	Baton Rouge	LA
Miami University-Oxford	Oxford	OH
Michigan State University	East Lansing	MI
Michigan Technological University	Houghton	MI
Missouri University of Science and Technology	Rolla	MO
New College of Florida	Sarasota	FL
New Mexico Institute of Mining and Technology	Socorro	NM
North Carolina State University at Raleigh	Raleigh	NC
Ohio State University-Main Campus	Columbus	OH
Oklahoma State University-Main Campus	Stillwater	OK
Pennsylvania State University-Main Campus	University Park	PA
Purdue University-Main Campus	West Lafayette	IN
Rutgers University-New Brunswick	New Brunswick	NJ
South Dakota School of Mines and Technology	Rapid City	SD
St Mary's College of Maryland	St. Mary's City	MD
Stony Brook University	Stony Brook	NY
SUNY at Binghamton	Vestal	NY
SUNY at Fredonia	Fredonia	NY
SUNY at Geneseo	Geneseo	NY
SUNY Institute of Technology at Utica-Rome	Utica	NY
Tennessee Technological University	Cookeville	TN
Texas A & M University-College Station	College Station	TX
The College of New Jersey	Ewing	NJ
The University of Tennessee	Knoxville	TN
The University of Texas at Austin	Austin	TX
The University of Texas at Dallas	Richardson	TX
Truman State University	Kirksville	MO
United States Air Force Academy	USAFA	CO
United States Coast Guard Academy	New London	CT
United States Military Academy	West Point	NY

United States Naval Academy	Annapolis	MD
University at Buffalo	Buffalo	NY
University of Arkansas	Fayetteville	AR
University of California-Berkeley	Berkeley	CA
University of California-Davis	Davis	CA
University of California-Irvine	Irvine	CA
University of California-Los Angeles	Los Angeles	CA
University of California-San Diego	La Jolla	CA
University of California-Santa Barbara	Santa Barbara	CA
University of California-Santa Cruz	Santa Cruz	CA
University of Central Florida	Orlando	FL
University of Colorado Boulder	Boulder	CO
University of Connecticut	Storrs	CT
University of Delaware	Newark	DE
University of Florida	Gainesville	FL
University of Georgia	Athens	GA
University of Illinois at Urbana-Champaign	Champaign	IL
University of Iowa	Iowa City	IA
University of Kansas	Lawrence	KS
University of Kentucky	Lexington	KY
University of Mary Washington	Fredericksburg	VA
University of Maryland-Baltimore County	Baltimore	MD
University of Maryland-College Park	College Park	MD
University of Massachusetts Amherst	Amherst	MA
University of Michigan-Ann Arbor	Ann Arbor	MI
University of Minnesota-Morris	Morris	MN
University of Minnesota-Twin Cities	Minneapolis	MN
University of Missouri-Columbia	Columbia	MO
University of Missouri-Kansas City	Kansas City	MO
University of Missouri-St Louis	Saint Louis	MO
University of Nebraska-Lincoln	Lincoln	NE
University of North Carolina at Asheville	Asheville	NC
University of North Carolina at Chapel Hill	Chapel Hill	NC
University of Oklahoma Norman Campus	Norman	OK
University of Pittsburgh-Pittsburgh Campus	Pittsburgh	PA
University of South Carolina-Columbia	Columbia	SC
University of Vermont	Burlington	VT
University of Virginia-Main Campus	Charlottesville	VA
University of Washington-Seattle Campus	Seattle	WA
University of Wisconsin-La Crosse	La Crosse	WI
University of Wisconsin-Madison	Madison	WI
Virginia Polytechnic Institute and State University	Blacksburg	VA

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