The Path to a Bachelor's Degree: The Effect of Starting at a Community College

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Community colleges are increasingly important in the postsecondary landscape as close to twenty states have enacted free community college plans to help alleviate rising college costs. I analyze the effect of community college enrollment on bachelor's degree attainment among United States students, utilizing propensity score matching to address bias. Relative to students who started at open access four-year colleges, those who started at community colleges were 10% less likely to earn a bachelor's degree. Further, the community college penalty disproportionately impacts upper middle-income students, Hispanics, and students with weaker academic backgrounds, thus widening the attainment gap among some demographics.

Keywords: higher education, community college, open-access four-year college, baccalaureate attainment, propensity score matching

INTRODUCTION

Community colleges expand access to higher education in the United States.[1] By offering both traditional higher education coursework and job training programs, community colleges are intended to serve as an intermediate step before a four-year college for some, and workforce training for others. In addition to serving a heterogeneous population of needs, many community colleges work within their areas to offer courses demanded locally (Bailey and Averianova, 1998; Cohen and Brawer, 2003). Recent legislation has increased demand for community colleges, as the opportunity cost of attendance has fallen drastically relative to four-year colleges. Thus, not only are those students requiring remediation choosing community colleges first, but students who are academically but perhaps not financially prepared for a four-year college are considering community colleges as well. Further, some students may use a community college to "try out" higher education and sample classes before selecting a major. Accordingly, community colleges are increasingly a key component in the pathway to a bachelor's degree. In this paper, I consider the potential value of free tuition policies by examining the effect of attendance at a community college on bachelor's degree attainment, and whether this effect varies by gender, socio-economic status, race, or academic preparation.

There are a vast number of private and social gains associated with increased educational attainment. Earnings are higher and the rate of unemployment is lower among workers with more education.[2] As the fastest growing occupations require postsecondary education, having a degree allows for a greater selection of job opportunities (Carnevale, Smith, and Strohl, 2014). Greater educational attainment is also tied to better health outcomes and behaviors, lower crime rates, and increased citizenship and community service (Cutler and Lleras-Muney, 2006; Levin, 2005; Lochner and Moretti, 2004; Psacharopoulos, 2006).[3] Even

with heavy subsidization of higher education, the government sees a positive rate of return to investment in college students on the order of 10% (Trostel, 2010).[4] This combination of private and social returns to education explain the urgency with which American policymakers seek strategies to alleviate obstacles in students' paths through postsecondary education.

Many states are beginning to enact policies in which community colleges are free to students, by providing "last-dollar" scholarships, or funding for tuition costs after financial aid and college grants have been applied. As of 2022, over half of the states in the United States offer some form of free tuition, although eligibility requirements vary state to state. This will likely increase the number of students choosing to attend a two-year program before transferring to a four-year program to complete a bachelor's degree. Comparing graduation rates between community colleges and open access four-year colleges allows for a discussion regarding the ease of transfer and institutional quality, while controlling for similar ability and backgrounds between student populations. It is imperative to identify the mechanisms that perpetuate the gap in baccalaureate attainment in order to inform policy decisions in the future. In the next section, I will review the relevant literature. A description of the data and methodology follow. The results and discussion, including the main contributions and important policy implications, conclude.

LITERATURE REVIEW

Proponents of community colleges argue that two-year colleges increase access to education (Cohen and Brawer, 2003; Medsker, 1960). Many students enter community colleges without a desire to earn a bachelor's degree, and the purpose of community colleges within neighborhoods is usually more than simply a bridge between high school and a bachelor's degree (Hoachlandar, Sikora, Horn, and Carroll, 2003). Nevertheless, the transfer function of community colleges has been an intrinsic component since their inception in the early twentieth century, and continues to grow in importance (Cohen and Brawer, 2003). Additionally, the changing landscape of community colleges over the last several decades may impact the ability with which students are able to utilize the transfer function (Grubb, 1991).

However, many studies have found that community colleges "divert" students from continuing their education. Early studies considered community college affects directly by comparing attainment outcomes of students who began at two-year colleges to those who began at four-year colleges. These studies identified differences in baccalaureate attainment between 10 and 20% (Anderson, 1981; Dougherty, 1992; Ganderton and Santos, 1995; Nunley and Breneman, 1988; Velez, 1985; Whitaker and Pascarella, 1994). However, these studies did not account for selection bias: students who enter two-year colleges might be different in unobservable ways, such as motivation or persistence, compared to students who begin in four-year programs.

Persistence in college is likely affected by many characteristics, from academic preparation to family background. For example, the gap in attainment has been found even when considering only "traditional" or full-time students (Christie and Hutcheson, 2003). Self-confidence and time studying may negatively impact the probability of transfer and graduation (Lanaan, 2007). Remedial courses may either increase or decrease the likelihood of transfer and persistence through a four-year degree (Martorell and McFarlin, 2011; Suzuki, Amrein-Beardsley, and Perry, 2012; Page and Clayton, 2016). Merit aid and subsidies may negatively impact some by diverting students away from higher quality colleges for which they were academically better suited (Cohodes and Goodman, 2014; Dynarski, 2008; Light and Strayer, 2000).

Even within socioeconomic groups, there is variation in access to financial aid resources (Page and Clayton, 2016). Women, and those from higher income families tend to choose more appropriate postsecondary choices and see higher completion rates (Bailey and Dynarski, 2011; Kinsler and Pavan, 2011). Additionally, access to and acquisition of student loans seems to negatively affect persistence in college (Dowd and Coury, 2006), particularly among African Americans (Perna, 2000; Kim, 2004).

Further, enrollment and persistence vary widely by ethnicity (Alon, Domina, and Tienda, 2010; Bowen, Chingos, and McPherson, 2009; Freeman, 2005; Fry, 2004; Ma and Baum, 2016; Nunez and Kim, 2012; Perna, 2000, 2007; Schneider, Martinez, and Owens, 2006; Wood and Williams, 2013). Hispanics may gravitate toward community colleges due to immigrant status, socio-economic status, and a mismatch of

information regarding four-year colleges and costs (Bowen, Chingos and McPherson, 2009; Fry, 2004; Light and Strayer, 2000; Nunez and Kim, 2012; Schneider, Martinez, and Owens, 2006). Several papers have indicated differences among subgroups in the ability to transfer status advantages (Alon, Domina and Tienda, 2010; O'Connor, 2009; Olivas, 1982). Among high income students, O'Connor (2009) determined that Hispanic students are at a disadvantage in starting at four-year programs, perhaps due to a language barrier. There is also evidence of racial gaps in college selectivity (Carnevale and Strohl, 2013). This has the potential to have serious consequences for students in terms of graduation rates, access to graduate schools, and labor market outcomes (Page and Clayton, 2016; Goodman, Hurwitz, and Smith, 2015).

Finally, while transfer to four-year programs seems to be holding students back from completing a four-year degree, students who successfully transfer seem to complete degrees at similar rates to rising juniors (Alba and Lavin, 1981; Alfonso, 2006; Bowen, Chingos, and McPherson, 2009; Dowd and Coury, 2006; Lee, Mackie-Lewis, and Marks, 1993; Melguizo, Kienzl, and Alfonso, 2011). While students may see a lag in grades due to "transfer shock," this appears to be temporary according to a few case studies (Cejda, Kaylor, and Rewey, 1998; Laanan, 2007; Townsend, 1993). However, transfer rates remain quite low nationally, and are lowest among minority and low-income groups, so the mechanism causing transfer difficulty requires additional consideration (Melguizo, Kienzl, and Alfonso, 2011).

Several studies have since used various methodologies to confirm a diversion effect of community college attendance even while controlling for selection bias (Alfonso, 2006; Christie and Hutcheson, 2003; Doyle, 2009; Gonzalez and Hilmer, 2006; Melguizo, Kienzl, and Alfonso, 2011; Long and Kurlaender, 2009; Reynolds, 2012; Rouse, 1995). However, only a few have employed propensity score matching (Doyle, 2009; Melguizo, Kienzl, and Alfonso, 2011; Long and Kurlaender, 2009; Reynolds, 2012). The concern with propensity score matching in this context is a small overlap between two-year and four-year college enrollees on observable factors (Agodini and Dynarski, 2004; Smith and Todd, 2005). Previous results suggest perhaps a stronger penalty when selection is accounted for, ranging from about 15% to almost 30% fewer baccalaureate degrees awarded to community college attenders (Long and Kurlaender, 2009; Doyle, 2009).[5]

Studies conducted on more narrowly defined samples and settings have seen similar results, suggesting that the opportunity to enroll in an open access four-year college over a community college is enough to improve graduation rates (Mountjoy, 2022; Goodman, Hurwitz, and Smith, 2015; Long and Kurlaender, 2009; Alba and Lavin, 1981). Long and Kurlaender (2009) consider a model most similar to what I will show below, and although they consider only Ohio students, find similar results to what I see nationwide.

Although a well thought out question, many of the studies above are decades old, do not control for selection bias, or do not address the possibility that certain populations are differentially impacted by enrollment decisions. Utilizing open access four-year college enrollments as a comparison group to two-year college enrollments allows for a much more comparable subset of students, as I will show below. Further, among those that do consider a model similar to what is below, these papers consider students from a specific state (Mountjoy, 2022; Goodman, Hurwitz, and Smith, 2017; Long and Kurlaender, 2009). Below, I address these concerns using a nationwide sample of students who graduated high school in 2004.

DATA

The National Center for Education Statistics collects data on students in the United States at various levels of education. The Education Longitudinal Study of 2002 (ELS: 2002) sampled high school sophomores across the United States in the spring of 2002 and followed these students through 2013. The complete data set includes transcript files from high school as well as any higher education transcripts through 2013.[6]

The full sample consists of 16,200 students.[7] As I am concerned with the effect of collegiate choices on educational outcomes, I include high school seniors in 2004 who indicated in 2002 or 2004 that they intended to earn at least a bachelor's degree, and went on to pursue postsecondary education in a public or non-profit private college. These modifications reduce the sample to 7,130 respondents, of which 1,600 started at a two-year college, 1,130 began at an open access four-year college, and 4,380 began at a selective

or very selective four-year college.[8] The outcome variables analyzed are whether the student earned at least a bachelor's degree within four, six, or nine years, as of June 2013, using the transcript data.

Descriptive Statistics

I begin by presenting descriptive statistics comparing students who begin at two-year, open access four year, and selective four-year colleges. All degree attainment in this paper refers to bachelor's degree attainment. Differentiating the sample by starting location identifies some basic characteristics that distinguish the types of students enrolled in each type of college. First, I consider the outcome of interest, bachelor's degree attainment. Overall, those that start at a two-year college are less likely to earn a bachelor's degree relative to those who start at either an open-access four-year college, or a selective four-year college. About 77% of students who start at a selective four-year college earned a bachelor's degree within nine years of high school graduation, but only 38% of those starting at two-year programs had earned a bachelor's degree, illustrating a potential diversion effect due to community college attendance.[9] Further, 48% of students at open access four-year colleges earn a bachelor's degree within nine years.

TABLE 1
BACCALAUREATE ATTAINMENT BY STARTING LOCATION

	Two-Year	Open Access Four-Year	Selective Four-Year
Earned BA (June 2008)	0.083	0.133	0.354
	(0.007)	(0.010)	(0.007)
Earned BA (June 2010)	0.263	0.372	0.702
	(0.011)	(0.014)	(0.007)
Earned BA (June 2013)	0.376	0.480	0.774
	(0.012)	(0.015)	(0.006)
Observations	1600	1130	4380

Standard errors in parentheses
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2020 (ELS: 2002). 2002–2012, including PETS.

As mentioned above, many observable characteristics influence an individual's choice among various post-secondary paths, and these likely impact their ability to complete a degree. In Table 2 below, students who begin their postsecondary experience at a two year or open access four-year college are statistically more likely to be African American or Hispanic, whereas those who start at a selective four-year college are more likely to be White or Asian. Those who start at a selective four-year college are also more likely to have stronger academic backgrounds, with average combined SAT scores almost 200 points higher and high school academic GPAs that are 0.5 points greater. Combined SAT scores and GPA were not statistically different between open access four-year college entrants and two-year college entrants, however.

Appendix A presents additional descriptive statistics. It further exemplifies the similarities between students who attend two year and open access four-year colleges as compared to those who attend selective four-year colleges. For example, among those who begin at a selective four-year college, individuals take statistically fewer remedial courses, have higher college GPA's, are more likely to attend full time, less likely to take a break, less likely to be a first-generation college student, and less likely to delay attendance relative to those who start at two year or open access four-year colleges. Further, selective four-year college attenders grow up in areas with higher per capita income, lower unemployment, and are more likely to attend private high schools in which the average math scores are higher and more peers attend four-year college.

TABLE 2
MEAN INDIVIDUAL CHARACTERISTICS BY COLLEGE STARTING, LOCATION OVERALL, AND BY RACE/ETHNICITY, FAMILY INCOME, AND MATH SCORE QUANTILE

Race/Ethnicity	Overall		White		African American		Hispanic		Asian	
Starting Location	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access Four Year
Gender (1: Male)	0.439	0.456	0.429	0.474	0.447	0.464	0.402	0.409	0.511	0.483
White	0.603	0.516								
Black	0.106	0.222								
Hispanic	0.121	0.117								
Asian	0.118	0.077								
Other	0.051	0.068								
Combined SAT Score	935	937.5	971.3	989.4	762.6	839.4	859.3	890.2	981.2	950.7
Verbal SAT Score	467.2	470.1	489.9	498.2	382.2	423.6	432.9	442.4	458.3	458.3
Math SAT Score	467.8	467.4	481.5	491.1	380.4	415.8	426.4	447.7	522.9	492.4
Math Score (ELS)	50.31	50.27	52.41	51.59	43.55	45.53	48.57	48	54.27	51.95
GPA (Weighted, HS)	2.819	2.83	2.911	2.965	2.303	2.481	2.654	2.82	3.009	2.965
GPA (PostSec, 1st year)	1.818	1.888	2.008	2.095	1.45	1.786	1.249	1.489	1.881	1.388
Over 50% Peers to 4-Yr	0.410	0.496	0.457	0.564	0.288	0.428	0.345	0.402	0.314	0.368
Attended full-time	0.741	0.848	0.769	0.832	0.718	0.876	0.634	0.856	0.734	0.805
Remedial Courses	1.591	1.285	1.148	0.947	3.418	1.76	2.289	1.841	1.468	1.379
Student Loan (1:Yes)	0.508	0.619	0.489	0.612	0.6	0.66	0.479	0.674	0.532	0.54
First Generation Student	0.214	0.195	0.19	0.172	0.212	0.184	0.289	0.288	0.266	0.31
Break from PS	0.647	0.497	0.616	0.44	0.706	0.596	0.825	0.591	0.569	0.425
Hours Worked (03-04)			3.226	2.911	3.341	3.076	2.851	2.447	1.915	1.92
Extracurricular Activities			2.376	2.369	2.165	2.34	1.974	2.273	2.17	2.207
Delay in PS	0.141	0.088	0.12	0.079	0.312	0.12	0.144	0.076	0.08	0.092
Observations	1600	1130	960	580	170	250	190	130	190	90

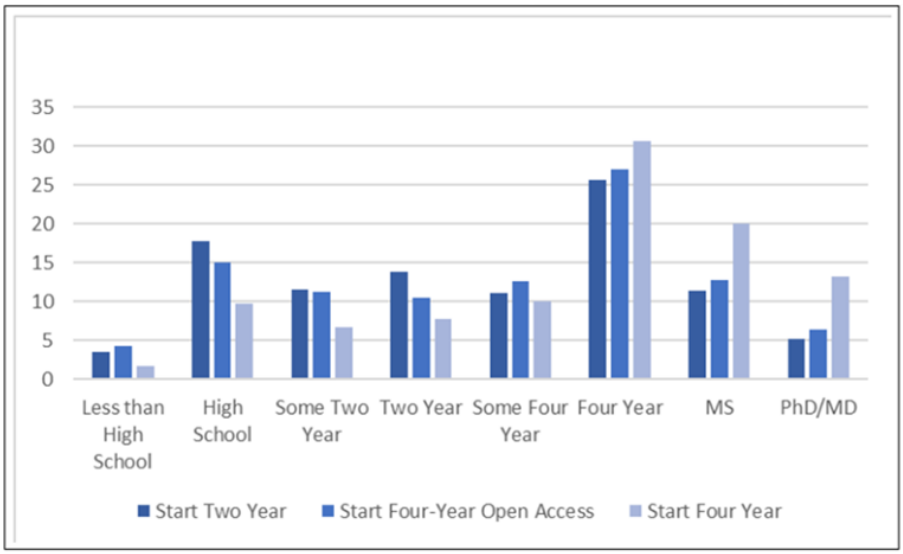
Family Income	< $35,000		$35,000-$50,000		$50,000-$75,000		$75,000-$100,000		> $100,000	
Starting Location	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access Four Year
Gender (1: Male)	0.4	0.393	0.427	0.509	0.451	0.482	0.436	0.435	0.519	0.5
White	0.453	0.32	0.602	0.495	0.688	0.645	0.688	0.636	0.681	0.615
African American	0.184	0.299	0.117	0.243	0.079	0.179	0.051	0.158	0.037	0.169
Hispanic	0.158	0.193	0.129	0.117	0.11	0.068	0.077	0.087	0.102	0.068
Asian	0.164	0.118	0.104	0.079	0.081	0.036	0.111	0.065	0.111	0.068
Other	0.042	0.07	0.049	0.065	0.042	0.072	0.073	0.054	0.069	0.081
Combined SAT	880.2	870.2	928.3	943.1	951.3	943.3	964.6	981.7	1000	1015.1
Verbal SAT Score	433.3	434.3	471.5	472.3	478.3	475.9	479.3	493.7	500.3	508
Math SAT Score	446.8	435.9	456.8	470.8	473	467.4	485.3	488	499.8	507.2
Math Score (ELS)	48.91	47.04	50.74	50.71	52.03	50.6	52.05	50.71	53.64	51.8
GPA (Weighted, HS)	2.757	2.711	2.782	2.884	2.86	2.78	2.862	2.944	2.886	2.958
GPA (PostSec)	1.616	1.6	1.679	1.988	1.871	1.999	2.213	2.104	1.922	1.931
Over 50% Peers to 4-Yr	0.28	0.417	0.392	0.383	0.423	0.538	0.509	0.598	0.579	0.642
Attended full-time	0.683	0.822	0.735	0.832	0.761	0.865	0.791	0.886	0.787	0.851
Remedial Courses	2.009	1.538	1.673	1.355	1.37	1.339	1.444	0.951	1.139	0.939
Student Loan (1:Yes)	0.53	0.622	0.55	0.645	0.509	0.645	0.517	0.636	0.389	0.507
First Generation	0.379	0.393	0.288	0.187	0.152	0.108	0.051	0.092	0.042	0.041
Break from PS	0.641	0.471	0.738	0.5	0.63	0.53	0.611	0.457	0.602	0.547
Hours Worked (03-04)	3.055	3.012	3.094	2.981	3.089	2.689	2.97	2.679	2.708	2.291
Extracurricular	2.236	2.284	2.243	2.304	2.257	2.41	2.462	2.424	2.347	2.419
Delay in PS	0.199	0.112	0.146	0.098	0.126	0.072	0.077	0.065	0.106	0.074
Observations	460	330	310	210	380	250	230	180	220	150

ELS Math Score Quartile	Quartile 1		Quartile 2		Quartile 3		Quartile 4		
Starting Location	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access Four Year	Two Year	Open Access	
Gender (1: Male)	0.326	0.405	0.396	0.412	0.435	0.427	0.579	0.594	
White	0.391	0.3	0.593	0.462	0.674	0.556	0.68	0.699	
African American	0.305	0.453	0.127	0.259	0.039	0.163	0.021	0.076	
Hispanic	0.19	0.142	0.125	0.144	0.109	0.103	0.082	0.08	
Asian	0.075	0.053	0.095	0.062	0.113	0.097	0.183	0.088	
Other	0.039	0.053	0.059	0.074	0.064	0.08	0.034	0.056	
Combined SAT Score	723.4	735.5	853.7	855.7	978.3	981.7	1133.7	1141.4	
Verbal SAT Score	366.7	375.5	436	436.7	492.5	491.4	546.6	558.2	
Math SAT Score	356.7	360	417.7	419	485.8	490.3	587.1	583.3	
Math Score (ELS)	38.65	37.59	46.86	45.39	53.4	52.09	62.47	61.72	
GPA (Weighted, HS)	2.349	2.323	2.602	2.631	2.968	2.952	3.237	3.317	
GPA (PostSec)	1.47	1.583	1.67	1.819	1.985	1.94	2.038	2.142	
Over 50% Peers to 4-Yr	0.341	0.4	0.385	0.491	0.435	0.519	0.458	0.546	
Attended full-time	0.692	0.774	0.712	0.844	0.767	0.868	0.78	0.88	
Remedial Courses	3.591	2.779	2.042	1.615	0.961	0.805	0.381	0.365	
Student Loan (1:Yes)	0.47	0.6	0.503	0.624	0.507	0.65	0.542	0.582	
First Generation Student	0.269	0.221	0.242	0.215	0.208	0.212	0.146	0.124	
Break from PS	0.659	0.6	0.745	0.488	0.598	0.516	0.585	0.406	
Hours Worked (03-04)	2.828	2.826	3.332	2.971	3.076	2.734	2.677	2.574	
Extracurricular Activities	2.039	2.232	2.138	2.356	2.39	2.39	2.532	2.406	
Delay in PS	0.208	0.163	0.154	0.085	0.118	0.080	0.106	0.044	
Observations	280	190	460	340	490	350	380	250	

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Parental education has been shown to have a strong influence on student behavior and attitudes towards schooling, and is likely to impact an individual's postsecondary decisions. Below in Figure 1, the level of parental education is shown relative to where an individual began their postsecondary experience. About 60% of individuals who started at a two-year college had parents who earned less than a bachelor's degree. On the other hand, just about one-third of individuals starting at a selective four-year college had parents with less than a bachelor's degree.

FIGURE 1
PARENTAL EDUCATION BY POST SECONDARY START

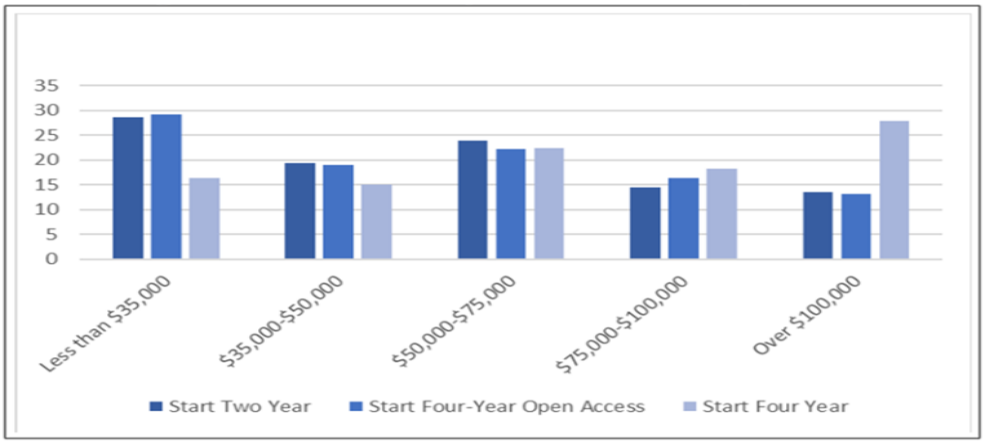


SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Family income is also likely to influence a person's decision with respect to postsecondary attendance. In Figure 2, I compare students' starting decisions based on their family income levels. Identifying individuals by their family income structure suggests that among those who started at a selective four- year college, almost half came from families with income over $75,000. Further, almost 30% of students who start at selective four-year colleges had family incomes of over $100,000. Alternatively, among those who started at a two-year college or open access four-year college, less than 30% had family income over $75,000. This disparity undoubtedly has implications in terms of access to college funding and attitudes toward lending, which then impacts postsecondary decisions (Page and Clayton, 2016).

Figures 1 and 2 collectively show some of the patterns in education due to family background. Those who start at a two-year college are more likely to come from families with income distributions that lean to lower or middle-income. Their parents additionally are more likely to have less than a bachelor's degree as compared to individuals who begin their postsecondary experience at a selective four-year college. Further, individuals who choose open access four-year colleges are more similar to those who choose two year colleges than they are to those who choose selective four year colleges in terms of family background.

FIGURE 2
INCOME BY POST SECONDARY START



SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

EMPIRICAL METHODOLOGY

Educational Choice Model Framework

Educational choice models are typically thought of in terms of a production function made up of several inputs: individual characteristics, family characteristics, school characteristics, and neighborhood characteristics (Hanushek, 1986; Wooldridge, 2002). Individual controls include gender, race/ethnicity, SAT math and verbal scores, and academic high school GPA (2004). SAT scores control for ability and also indicate a desire to attend a four-year college. Family controls include parent income in 2002 and education level, both of which are strongly correlated with student's education levels. School controls include whether the school is in an urban location, whether the high school is public, and the average math score on a senior year ELS proctored exam attained by an individual's cohort.[10] Finally, geographic differences are controlled for using the individual's census location. While including state dummies might better control for state policy variations, small sample sizes become a concern. Further, in the propensity score models below I don't match on states directly, so regional variables are sufficient to control for regional differences and to improve the propensity score match and thus are more applicable here.

Educational decisions have been long thought of as endogenous, depending on unobserved characteristics such as ability or motivation. Students' postsecondary decisions are likely a function of these unobserved factors. Due to the probable endogeneity of attendance together with the nature of the data, care must be taken in modeling decisions. Although traditional regression estimates do not account for selection bias, these estimates provide a comparison to previous results. Equation (1) below shows the baseline model as estimated by a probit model, where the control variables, X_i, include individual, family, school, and neighborhood characteristics as described above.

$$Y_i = \rho S_i + \beta' X_i + \varepsilon_i \quad (1)$$

In the above equation, Y_i denotes the outcome variable, which represents bachelor's degree attainment in four, six, or nine years, depending on the model. S_i denotes the starting location: either a student begins at a two-year college or a four-year college. For the purposes of comparing similar students, I included the effect of starting at a community college to students who started at an open access four-year college in the top panel. This will be most similar to the propensity score results to follow. However, to compare to previous literature, I also compared two-year college goers to all college goers in the bottom panel. In each

case, only students who expressed an interest in earning a bachelor's degree were included in the analysis, as the reason to attend a two-year school can vary dramatically. The results of these regressions, as a baseline probit model, are below in Table 3 with marginal effects reported.

TABLE 3
BASE LINE ESTIMATES: PROBIT MODEL
DEPENDENT VARIABLE – BACHELOR DEGREE ATTAINMENT

3A: Open Access Four-Year vs Two-Year Colleges						
Start At			Four Year BA			
Two-Year College	-0.049***	-0.057***	-0.054***	-0.040***	-0.037***	-0.330***
	(0.012)	(0.012)	(0.011)	(0.010)	(0.009)	(0.009)
Pseudo R^2	0.010	0.033	0.050	0.170	0.177	0.198
Start At			Six Year BA			
Two-Year College	-0.108***	-0.134***	-0.129***	-0.119***	-0.113***	-0.114***
	(0.021)	(0.021)	(0.024)	(0.022)	(0.017)	(0.020)
Pseudo R^2	0.011	0.034	0.060	0.170	0.178	0.188
Start At			BA (June 2013)			
Two-Year College	-0.103***	-0.135***	-0.130***	-0.119***	-0.115***	-0.117***
	(0.018)	(0.017)	(0.016)	(0.019)	(0.019)	(0.020)
Pseudo R^2	0.008	0.034	0.059	0.149	0.154	0.160
3B: All Four-Year vs Two-Year Colleges						
Start At			Four Year BA			
Two-Year College	-0.312***	-0.306***	-0.277***	-0.172***	-0.159***	-0.143***
	(0.017)	(0.017)	(0.018)	(0.019)	(0.015)	(0.015)
Open Access Four-Year College	-0.227***	-0.203***	-0.179***	-0.083***	-0.075***	-0.065***
	(0.016)	(0.015)	(0.017)	(0.020)	(0.016)	(0.018)
Pseudo R^2	0.077	0.094	0.113	0.195	0.202	0.224
Start At			Six Year BA			
Two-Year College	-0.461***	-0.458***	-0.422***	-0.296***	-0.277***	-0.269***
	(0.018)	(0.015)	(0.014)	(0.018)	(0.020)	(0.021)
Open Access Four-Year College	-0.340***	-0.310***	-0.280***	-0.158***	-0.145***	-0.143***
	(0.017)	(0.019)	(0.017)	(0.025)	(0.023)	(0.021)
Pseudo R^2	0.114	0.127	0.150	0.243	0.252	0.260
Start At			BA (June 2013)			
Two-Year College	-0.395***	-0.390***	-0.353***	-0.232***	-0.217***	-0.212***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.014)
Open Access Four-Year College	-0.297***	-0.267***	-0.236***	-0.125***	-0.114***	-0.113***
	(0.016)	(0.016)	(0.015)	(0.019)	(0.020)	(0.015)
Pseudo R^2	0.101	0.117	0.143	0.225	0.232	0.237

Baseline	x	x	x	x	x	x
Demographics[a]		x	x	x	x	x
Parent Background[b]			x	x	x	x
Academic Background[c]				x	x	x
School Characteristics[d]					x	x
Geographic Characteristics[e]						x
Observations	7130					

Standard errors in parentheses, marginal effects reported
Adjusted for survey data (standard errors clustered by school)
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
a: gender, race; b: parent income (2001), parent education level; c: SAT Verbal, SAT Math, High School GPA; d: public school, average math score (2004); e: urbanicity, census region
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Looking at the top panel, relative to starting at an open-access four-year college, starting at a two-year college decreases the probability of graduating within nine years by about 12%, using the model with all observable characteristics included. Looking at the bottom panel, relative to starting at a selective college, starting at a two-year college decreases the probability of graduating within nine years by about 21%. Starting at an open access four-year college decreases the chances of graduation by 11%. These estimates are similar to early research that did not control for selection bias. As it is unlikely that students randomly select into community colleges, accounting for endogeneity is imperative to obtain consistent estimates, and why I turn to propensity score methods.

Propensity Score Matching

To control for selection bias, I use propensity score matching to compare the results of baccalaureate attainment between those who start at two-year colleges and those who start at open access four-year colleges. I use these two groups specifically because they are more comparable on observable (and likely unobservable) characteristics than compared to the full set of four-year college attendees. Selection into postsecondary institutions is not random, and likely positively biases unadjusted estimates. Matching methods are a way to identify causal impacts when structural models are not sufficient to eliminate bias, contingent upon proper balance and sufficient overlap between treatment and control groups. Propensity score matching does not rely on functional form assumptions.

Below, I analyze the probability of earning a bachelor's degree in four, six, or nine years if the student starts at a two-year college rather than an open access four-year college. The treatment effect in each case is starting at a two-year college (D = 1) rather than an open-access four-year college (D = 0). Although this subsample is smaller, this analysis will address the impact on students intending to earn a bachelor's degree while maintaining the plausibility of a similar sample in both treatment and control groups. Ideally one would estimate: $T_i = Y_{1i} - Y_{0i}$, where $Y_{1i}$is the outcome for respondent i if they are in the treatment group and $Y_{0i}$is the outcome for respondent i if they are in the control group. However, for each individual i, I only observe one outcome, and the other is the counterfactual. Thus, in place of an individual treatment effect, I estimate the average treatment effect on the treated, which is given as:

$$E[Y_{1i}|X, D = 1] - E[Y_{0i}|X, D = 1] \quad (2)$$

As the counterfactual mean of those who earn a bachelor's degree is not observed, the value of $E[Y = 0|X, D = 1]$ is calculated using a close substitute. This requires a few additional steps and assumptions that are discussed below (Becker and Ichino, 2002; Blundell and Dias, 2009; Caliendo and Kopeinig, 2008; Dejijia and Wahba, 1999, 2002; Heckman, Ichimura, and Todd, 1997, 1998; Rosenbaum and Rubin, 1983; Rubin, 1974; Wooldridge, 2002). Rather than matching on all observed variables independently, I use the

propensity score, or the probability an individual will start at a two-year college (Rosenbaum and Rubin, 1983).

Variable Choice

Once observable characteristics, X, are controlled for, the difference in bachelor's degree attainment can be attributed to the choice of postsecondary attendance. The decision to include or ignore a variable is thus critical to reliable estimates. It is important to include variables that are expected to impact postsecondary decisions and earning a bachelor's degree, but they must be either time invariant or have occurred prior to postsecondary decisions (Caliendo and Kopeinig, 2008). Variable choice requires a balance of outcomes; omitted important variables can lead to increased bias but irrelevant variables may increase variance (Augurzky and Schmidt, 2000; Bryson, Dorsett, and Purdon, 2002; Rubin and Thomas, 1996). Caliendo and Kopeinig (2008) suggest using a combination of theory, the hit or miss method, and statistical significance to justify the inclusion of or exclusion of variables. Table B1 in Appendix B identifies the 'hit' probability for each model, the Wald χ^2test statistic and pseudo-R^2 (Heckman, Ichimura, Smith, and Todd, 1998). The probability of a 'hit' calculates the within-sample correct prediction rate.[11] I used a model's 'hit' value together with statistical significance to determine the set of variables to include in each model. Further, the fact that the matched samples' pseudo-R^2's dropped suggests that observable factors no longer predict postsecondary choice, thus balancing the groups (Caliendo and Kopeinig, 2008; Sianesi, 2004). Appendix C outlines variable choice decisions, which include: gender, race/ethnicity, family income, parental education, SAT score, high school GPA, the average ELS math score in the high school attended, the percent of students who went to a four-year college, whether it was a public high school, extracurricular activities, urbanicity of the high school, and region. As there were several different subgroup models run, the exact makeup of the included variables varies, but is detailed in Appendix D.

Model Assumptions

In a randomized control trial, the treatment and control group are identical except for receiving the treatment. In this context, that is an impossible assumption. However, it has been shown that if the conditional independence assumption (CIA) holds, we can estimate the average treatment effect on the treated conditional on the covariates. The CIA says that potential outcomes are independent of treatment selection, conditional on a set of observed variables. In other words, $E[Y_{1i}|X, D] = E[Y_{1i}|X]$ and $E[Y_{0i}|X, D] = E[Y_{0i}|X]$.

To confirm this assumption, I compare the means between each treatment and control group. Each standardized difference should be close to zero and variance ratio close to one to indicate a quality match.[12] Additionally, I confirm that the standardized bias in each model is below 5%, a value deemed sufficient to confirm balance (Caliendo and Kopeinig, 2008; Rosenbaum and Rubin, 1985).[13] The pseudo-$R^2$is also lowered due to matching, as shown in Appendix C, Table C1. All models additionally were stratified and balanced block by block using a two-sample t-test.[14]

The second assumption requires sufficient overlap between treatment and control groups. That means that for any individual *i*, there must be a matching individual *j* in the other group. In other words, no individual is either certain to take the treatment, or will never take the treatment. The overlap assumption is visually shown in Appendix E. Figures E1-E19 graph the propensity scores of those in the treatment and control group, clearly showing the overlap assumption holds in each model.

Matching Methods

Deciding on an algorithm is the next step in propensity score matching. Below I will present four algorithm results: nearest neighbor, stratification, kernel, and radius matching. Nearest neighbor matching will take each observed propensity score in the treatment group and match the individual with the closest propensity score among the control group.[15] Matching with replacement, or potentially using an observation multiple times, allows for better matches (decreasing bias), but may increase variance as control group scores may be used more than once (Caliendo and Kopeinig, 2008). Stratification imposes a similar matching process, but restricts the feasible matches to observations within the same strata. The number of

strata depend on the data, and are picked such that the treatment and control groups within each are balanced. The kernel matching method uses all control observations, but assigns weights based on how close the score is to the treatment score.[16] The radius matching method limits the observations to being within a certain distance from the treatment (Deijia and Wahba, 2002).[17] The kernel and radius methods increase the potential bias, as they use less useful data, but offer increased efficiency, and with that, precise estimates (Heinrich, Maffioli, and Vazquez, 2010). As each model has its trade-offs, I present bounds in the results below.

RESULTS

The results below in Table 4 indicate the effect of starting at a two-year college on earning a bachelor's degree within four, six, or about nine years after high school graduation.

The negative effect of starting at a community college on baccalaureate attainment within four years was between 2.6% and 4.5%. This small impact is likely due to low graduation rates within four years for all groups. However, the penalty for starting at a community college grows by the six- or nine-year graduation marks. Individuals who start at a two-year college are between 7.7% and 10.8% less likely to graduate within six years and between 9.2% and 11.1% less likely to graduate within nine years. Focusing on graduation rates within nine years, these results suggest that students who attend a two-year college are about 10% less likely to complete a bachelor's degree compared to similar students who enrolled at a open access four year college initially.[18]

That is, the community college penalty is estimated to be about 10% in terms of baccalaureate attainment, but this is likely to vary by demographics. Several of these are considered below.

TABLE 4
THE EFFECT OF STARTING AT A TWO YEAR COLLEGE ON BACCALAUREATE ATTAINMENT

Matching Method	Four Year BA	Six Year BA	June 2013 BA
NN	-0.026	-0.080***	-0.098***
	(0.019)	(0.028)	(0.029)
Stratification	-0.026**	-0.085***	-0.096***
	(0.012)	(0.021)	(0.023)
Kernel	-0.031**	-0.094***	-0.103***
	(0.013)	(0.021)	(0.022)
Radius	-0.046***	-0.114***	-0.118***
	(0.011)	(0.018)	(0.021)
Common Support: [.191, .929]			
Pseudo R^2 0.087			

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Included covariates: gender, race, parent income and education, high school GPA, SAT Verbal, SAT Math, public school, average math score, urbanicity of school, census region
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Subgroup Analysis: Gender

Women tend to enroll in college in greater numbers. In this sample, the percent of women enrolled in two year and open access four-year colleges was not statistically different, but overall, women made up about 60% of each sample. In looking at the results in Table 5 below, I consider the effect of community college enrollment by gender.

Relative to the overall result, it seems women are perhaps slightly more negatively impacted by starting at a two-year college, but the bounds overlap. Within nine years of high school graduation, women who enroll in a two-year college are 9-11% less likely to earn a degree, and men are 9-10% less likely. That is, the lower bound is about the same, but the upper bound for women is larger.

TABLE 5
THE EFFECT OF GENDER ON BACCALAUREATE ATTAINMENT

		Female	
Dependent Variable	Four Year BA	Six Year BA	June 2013 BA
Start at Two Year			
NN	-0.020	-0.078*	-0.092**
	(0.028)	(0.041)	(0.043)
Stratification	-0.031	-0.096***	-0.109***
	(0.022)	(0.031)	(0.033)
Kernel	-0.031	-0.096***	-0.108***
	(0.019)	(0.029)	(0.032)
Radius	-0.040**	-0.116***	-0.118***
	(0.017)	(0.026)	(0.027)
Common Support [.202, .942]			
Pseudo R^2 0.1046			
		Male	
Dependent Variable	Four Year BA	Six Year BA	June 2013 BA
Start at Two Year			
NN	-0.007	-0.037	-0.064
	(0.023)	(0.039)	(0.042)
Stratification	-0.034**	-0.088***	-0.090***
	(0.016)	(0.029)	(0.032)
Kernel	-0.037**	-0.098***	-0.101***
	(0.018)	(0.028)	(0.033)
Radius	-0.046***	-0.100***	-0.104***
	(0.017)	(0.026)	(0.027)
Common Support [0.219, .895]			
Pseudo R^2: 0711			

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Included covariates: gender, race, parent income and education, high school GPA, SAT Verbal, SAT Math, public school, average math score, urbanicity of school, census region
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Subgroup Analysis: Income

As income rises, the probability of earning a bachelor's degree conditional on starting location also rises (Kinsler and Pavan 2011). In this sample, the gap in nine-year baccalaureate attainment between the

highest and lowest income brackets is 20 percentage points for those who start at a community college and 24 percentage points for those who start at an open access four year college. Family income plays a large role in terms of access to funding, aid, and loans, and likely also plays a role in attitudes towards loans and the future value of college investment. Below, in Table 6, I consider the effect of attending a community college on baccalaureate attainment by different income brackets.

TABLE 6
THE EFFECT OF INCOME ON BACCALAUREATE ATTAINMENT

Dependent Variable	Four Year BA	Six Year BA	June 2013 BA
Income Quintile 1: < $35,000			
NN	-0.066**	-0.127***	-0.138***
	(0.028)	(0.045)	(0.049)
Stratification	-0.035*	-0.103***	-0.111***
	(0.021)	(0.034)	(0.037)
Kernel	-0.033	-0.101***	-0.105***
	(0.020)	(0.034)	(0.038)
Radius	-0.029	-0.092***	-0.090***
	(0.020)	(0.030)	(0.035)
Common Support	[0.305,0.831]	Pseudo R^2	0.046
Income Quintile 2: $35,000-$50,000			
NN	-0.019	-0.123**	-0.116*
	(0.039)	(0.061)	(0.066)
Stratification	-0.034	-0.073	-0.099**
	(0.029)	(0.046)	(0.050)
Kernel	-0.035	-0.074	-0.109**
	(0.029)	(0.046)	(0.050)
Radius	-0.049	-0.090**	-0.116**
	(0.034)	(0.042)	(0.048)
Common Support	[0.201,0.940]	Pseudo R^2	0.108
Income Quintile 3: $50,000-$75,000			
NN	-0.031	-0.068	-0.057
	(0.038)	(0.054)	(0.058)
Stratification	-0.016	-0.041	-0.036
	(0.024)	(0.040)	(0.047)
Kernel	-0.026	-0.048	-0.025
	(0.025)	(0.042)	(0.045)
Radius	-0.034	-0.063*	-0.027
	(0.027)	(0.037)	(0.041)
Common Support	[0.215,0.919]	Pseudo R^2	0.080
Income Quintile 4: $75,000-$100,000			
NN	0.056	-0.175**	-0.205***
	(0.041)	(0.068)	(0.067)
Stratification	0.030	-0.155***	-0.180***
	(0.029)	(0.058)	(0.059)
Kernel	0.016	-0.170***	-0.188***
	(0.031)	(0.050)	(0.054)
Radius	0.003	-0.194***	-0.204***
	(0.036)	(0.050)	(0.052)
Common Support	[0.097, 0.845]	Pseudo R^2	0.097

Income Quintile 5: > $100,000			
NN	-0.130**	-0.171**	-0.162**
	(0.066)	(0.079)	(0.077)
Stratification	-0.071*	-0.117**	-0.127**
	(0.039)	(0.055)	(0.055)
Kernel	-0.099**	-0.101	-0.105*
	(0.045)	(0.063)	(0.058)
Radius	-0.116***	-0.101*	-0.121**
	(0.042)	(0.059)	(0.059)
Common Support	[0.117,0.949]	Pseudo R^2	0.092

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Included covariates: gender, race, parent education, high school GPA, SAT Verbal and Math, public school, average math score, urbanicity of school, census region
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

In this subgroup, it appears that, relative to the overall impact, those in the upper middle-income bracket ($75,000 -$100,000) are the most drastically impacted. They are 16- 19% less likely to earn a bachelor's degree within nine years relative to their peers who start at open access four-year colleges. For comparison, within nine years, those in the lowest income bracket (< $35, 000) are about 9-13% less likely to earn a bachelor's degree, those in the second bracket are 9-11% less likely, the middle bracket is least affected at 2-6% (and not precisely estimated), and those in the top income bracket are 10-15% less likely, which is about the same as the overall impact, although there is a greater upper bound.

Upper middle-class students may be most impacted financially, and this may affect their decision making when considering college options. Low-income students are more likely to have college funded through outside sources like Pell Grants or other aid. High income individuals are less likely to need outside funding. Middle class students may need the aid, but not qualify for it. This financial impact could encourage some to choose a less expensive option.

Subgroup Analysis: Race/Ethnicity

African American and Hispanic students enroll in community colleges in greater numbers, as noted above. In this sample, African Americans are over 50% more likely to enroll in a two-year college versus a selective four-year college, and Hispanics are almost twice as likely. Unfortunately, small sample sizes impact the precision of some of the estimates below, but the results below in Table 7 show the effect of community college enrollment on baccalaureate attainment by race.

TABLE 7
THE EFFECT OF RACE ON BACCALAUREATE ATTAINMENT

Dependent Variable	Four Year BA	Six Year BA	June 2013 BA
		White	
NN	-0.018	-0.086**	-0.105***
	(0.024)	(0.035)	(0.036)
Stratification	-0.031*	-0.093***	-0.098***
	(0.017)	(0.026)	(0.028)
Kernel	-0.037**	-0.098***	-0.108***
	(0.015)	(0.025)	(0.031)
Radius	-0.036**	-0.103***	-0.114***
	(0.018)	(0.026)	(0.029)
Common Support	[.236, .854]	Pseudo R^2	0.045
		African American	
NN	-0.029	0.006	0.047
	(0.034)	(0.053)	(0.060)
Stratification	-0.020	-0.003	0.022
	–	–	
Kernel	-0.025	-0.008	0.014
	(0.016)	(0.037)	(0.044)
Radius	-0.040*	-0.034	-0.011
	(0.021)	(0.037)	(0.044)
Common Support	[.081, .829]	Pseudo R^2	0.093

Hispanic			
NN	0.022	-0.066	-0.126
	(0.038)	(0.082)	(0.091)
Stratification	-0.013	-0.118**	-0.147**
	(0.026)	(0.046)	(0.072)
Kernel	-0.014	-0.130***	-0.185***
	(0.028)	(0.049)	(0.071)
Radius	-0.035	-0.183***	-0.198***
	(0.031)	(0.054)	(0.059)
Common Support	[.137, 0.969]	Pseudo R^2	0.133
Asian			
NN	0.005	-0.054	-0.119
	(0.061)	(0.097)	(0.092)
Stratification	-0.003	-0.090	-0.119*
	(0.048)	(0.069)	(0.064)
Kernel	0.005	-0.061	-0.094
	(0.042)	(0.070)	(0.069)
Radius	0.009	-0.038	-0.067
	(0.047)	(0.074)	(0.074)
Common Support	[.184, .939]	Pseudo R^2	0.078

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Included covariates: gender, parent income and education, high school GPA SAT Verbal, SAT Math, public school, average math score, urbanicity of school, census region
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

The impact on Hispanic individuals is striking; Hispanic students that enroll in a two-year college are between 12 and 18% less likely to earn a bachelor's degree within nine years. Since Hispanic students are already more likely to enroll in a two-year college, this result is all the more important.[19] White students, on the other hand, are 9-11% less likely to earn a degree when starting at a two-year college, or about the same as the overall result. The results for African American students and Asian individuals were not statistically significant across specifications, so I interpret these subgroup results with caution. There is suggestive evidence of a penalty on the order of 11% for Asian students, but it is not consistent.

Subgroup Analysis: Academic Achievement

Finally, I considered the impact of collegiate attendance by academic background, as measured by the ELS proctored math exam. If students seek community colleges to save money before earning a bachelor's degree, better prepared students should not have as much difficulty transferring to a four-year college. On the other hand, students with lower academic credentials might be better able to adjust to college level work if they start at a community college (Light and Strayer, 2000). A student might be able to build up their confidence and ability while at a community college before transferring to a more difficult academic environment. However, there is some evidence that a more rigorous academic placement and the peer group might increase a student's likelihood of completing a degree (Alon and Tienda, 2005; Kane, 1998). Further, weaker preparation for college level work may account for a large amount of the community college penalty (Bound, Lovenheim, and Turner, 2009).

Below, in Tables 8A and 8B, I analyze the effect of starting at a community college based on the individual's academic background.

In terms of nine-year graduation rates, the lowest quartile saw impacts of 11-12%, meaning that by attending a two-year college, a student would be 11-12% less likely to earn a degree as compared to starting an open access four-year college. The penalty for those in the second quartile was 12-13%, the third quartile, 7-8%, and the highest quartile, 8-12%. That is, although the upper bound for the top quartile is large, overall, the impacts on bachelor degree attainment are greater among those with weaker academic backgrounds.

As math scores on a proctored ELS exam may not be the best indicator of ability, I additionally separate students by high school GPA. The weaker group (GPA < 3.0) fared worse, where the community college penalty was 11-15% relative to those in open access four-year colleges. Those with stronger backgrounds (GPA > 3.0) had a smaller than average penalty of 7-9% relative to their peers in open access four-year colleges.

Overall, these results suggest that those with weaker academic backgrounds suffer a greater penalty from attending a community college on degree attainment. This could be due to a higher need for remedial coursework, not attending full-time, or being more likely to be a first-generation college student relative to

the other groups. These factors likely impact the ability for some students to make strategic collegiate choices and maximize their experience. Further, as they have weaker academic skills, they may face a higher opportunity cost of education. Several studies also suggest that not identifying a proper postsecondary match can have negative implications (Bowen, Chingos, and McPherson, 2009; Light and Strayer, 2000; Roderick, Coca, and Nagaoka, 2011). Once improperly matched at a lower-ranked school, lower peer quality might impact student performance and persistence.

TABLE 8A
THE EFFECT OF ACADEMIC BACKGROUND ON BACCALAUREATE ATTAINMENT

Dependent Variable	Four Year BA	Six Year BA	June 2013 BA
Math Quartile 1			
NN	-0.061*	-0.129**	-0.129**
	(0.030)	(0.052)	(0.061)
Stratification	-0.046**	-0.097**	-0.127***
	(0.021)	(0.038)	(0.046)
Kernel	-0.046**	-0.094**	-0.125***
	(0.020)	(0.038)	(0.046)
Radius	-0.047**	-0.086**	-0.122***
	(0.022)	(0.040)	(0.044)
Common Support	[0.367, 1]	Pseudo R^2	0.062
Math Quartile 2			
NN	-0.037	-0.188***	-0.137***
	(0.025)	(0.046)	(0.049)
Stratification	-0.044	-0.153	-0.128
	–	–	–
Kernel	-0.046**	-0.150***	-0.125***
	(0.019)	(0.034)	(0.039)
Radius	-0.048**	-0.152***	-0.127***
	(0.021)	(0.035)	(0.041)
Common Support	[.135, .809]	Pseudo R^2	0.062
Math Quartile 3			
NN	-0.047	-0.123**	-0.082*
	(0.032)	(0.047)	(0.048)
Stratification	-0.013	-0.073	-0.072
	–	–	–
Kernel	-0.017	-0.068*	-0.072*
	(0.023)	(0.037)	(0.040)
Radius	-0.009	-0.065**	-0.070
	(0.022)	(0.033)	(0.044)
Common Support	[.111, .840]	Pseudo R^2	0.075

Math Quartile 4			
NN	-0.045	-0.098	-0.087
	(0.052)	(0.065)	(0.063)
Stratification	-0.071*	-0.100**	-0.131***
	(0.038)	(0.047)	(0.044)
Kernel	-0.076**	-0.103***	-0.124***
	(0.034)	(0.038)	(0.047)
Radius	-0.077**	-0.111***	-0.118***
	(0.039)	(0.042)	(0.042)
Common Support	[.176, .957]	Pseudo R^2	0.068

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Included covariates: gender, race, parent income and education, high school GPA SAT Verbal, SAT Math, public school, average math score, urbanicity of school, census region
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

TABLE 8B
THE EFFECT OF ACADEMIC BACKGROUNG ON BACCALAUREATE ATTAINMENT

	Four Year BA	Six Year BA	June 2013 BA
Low GPA			
NN	-0.026*	-0.121***	-0.157***
	(0.016)	(0.029)	(0.033)
Stratification	-0.022	-0.096	-0.113
	–	–	–
Kernel	-0.025**	-0.098***	-0.114***
	(0.010)	(0.021)	(0.023)
Radius	-0.026**	-0.101***	-0.117***
	(0.012)	(0.020)	(0.025)
Common Support	[.187, .818]	Pseudo R^2	0.052
High GPA			
NN	-0.045	-0.099**	-0.076*
	(0.037)	(0.044)	(0.043)
Stratification	-0.060**	-0.119***	-0.098***
	(0.027)	(0.034)	(0.033)
Kernel	-0.060**	-0.110***	-0.090***
	(0.030)	(0.033)	(0.031)
Radius	-0.061**	-0.111***	-0.092**
	(0.028)	(0.034)	(0.037)
Common Support	[.127, .836]	Pseudo R^2	0.059

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Included covariates: gender, race, parent income and education, high school GPA SAT Verbal, SAT Math, public school, average math score, urbanicity of school, census region
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Sensitivity Analysis

If two individuals have the same observed variables but differ on an unobserved characteristic such as motivation or ability, they will then have different chances of enrolling in a two-year college. As motivation is a plausible unobserved variable, I consider how important a factor would have to be in order to completely explain the estimates. Using two methods below, I estimate how large the effect of such an unobserved variable would have to be in order to completely explain the results.

The first method identifies the sensitivity of the results to an unobserved binary variable with Mantel-Haenszel bounds (Aakvik, 2001; Becker and Caliendo, 2007).[20] The results, which are shown in Appendix F Table F1, indicate that the confidence interval of the main result, the effect of starting at a community college on nine-year graduation rates, would include zero if the unobserved variable (eg. motivation) caused the odds ratio of starting at a two-year college to differ between the treatment and control groups by a factor of 1.25-1.3. In other words, the results are sensitive to bias that decrease the odds of treatment by more than 25%. Although some results suggest a higher sensitivity to bias (for example, the income models excluding the fourth category), others, such as the gender, GPA, or Hispanic models, suggest a lower sensitivity to hidden bias. This does not necessarily mean that an included variable absolutely will change the magnitude or significance of the results, simply that these results may be sensitive to missing variables, and that results should be interpreted with some caution.

Using another method proposed by Ichino, Mealli and Nannicini (2006), I test the sensitivity of a potentially confounding binary variable, U, which may be motivation or persistence in this context. U is simulated using p_{ij}, which is the probability that $U = 1$ when $D = i$ and $Y = j$; $(i, j \in 0, 1)$. In this context $d = p_{01} - p_{00} > 0$, as motivation is expected to have a positive impact on earning a bachelor's degree, and $s = p_1 - p_0 < 0$, as motivation is expected to have a negative impact on the decision to start at a two-year college as compared to an open-access four-year college. That is, the confounding variable, U, has a positive effect on the outcome and a negative effect on treatment assignment. All results are presented in Appendix F Tables F2 - F3.[21] Simulations with various values of s and d help to identify how large the impact would need to be in order to threaten the results. For example, in the baseline model, to explain 53.4% of the effect, the unobserved variable would need to increase the probability of earning a bachelor's degree by more than four-fold and decrease the probability of starting at a two-year college by a factor of 0.43. Overall, about 42% of individuals graduated with a bachelor's degree within nine years. To increase that value by four times would mean more than 100% of students earn a bachelor's degree. Further, as 58.6% of individuals sampled started at a two-year college, decreasing this by a factor of 0.43 would mean only 33.4% choose a two-year college, or about 690 fewer students. Most of the models present similar results; that is, the unobserved covariate would need to have a substantial impact on selection into college and on attainment in order to seriously impact the results.

These two tests combined provide evidence that the results presented above are possibly subject to some sensitivity of hidden bias but that it would require a large, and possibly implausible effect to completely remove the community college penalty in its entirety.

DISCUSSION

The results above indicate that baccalaureate attainment within nine years is about 9-11% lower among students who begin their postsecondary experience in a community college as compared to those who begin in open access four-year colleges. This is a smaller impact than was seen in Long and Kurlaender (2007) in studying Ohio students, but the effect is significant, and seen across specifications. The effect found here is also similar, although smaller relative to older results, which compared community college attenders to all four-year college attenders (Alba and Lavin, 1981; Alfonso, 2006; Dowd and Coury, 2006; Leigh and Gill, 2003; Reynolds, 2012; Rouse, 1995; Sandy, Gonzalez, and Hilmer, 2006).

The negative impact of community college enrollment disproportionately impacts some more than others. First, however, women and men seem to be affected similarly, with about 9-11% penalties from community college attendance. This differs from previous research which found women to be more

negatively impacted (Long and Kurlaender, 2007). Women do enroll in greater numbers, though, so it is possible that men feel the impact more.

Upper middle-income students (families earning between $75,000 and $100,000) seem to be more negatively impacted, relative to other income categories. This is perhaps due to lower amounts of financial aid allocated to higher income groups while college affordability is still plausibly difficult. This group may feel additional pressure to attend a cheaper institution to save money, especially among those not as academically gifted. Among those who start at a community college in the fourth income bracket ($75,000-$100,000), 52% have student loans, but only 39% of those in the highest bracket (>$100,000) who start at community college have loans. The community college penalty for the upper middle-income group is 16-19%, higher than any other subgroup.

One of the largest impacts seen in the subgroup analysis was among Hispanics, who were between 12-18% less likely to graduate within nine years. This penalty implies they are significantly less likely, relative to White and Asian students, and possibly African American students, to not complete a bachelor's degree when they start at a community college. This may be in part due to a lower likelihood of attending full time (63%) and a higher likelihood of being a first-generation college student (29%), relative to their peers.[22] Further, Hispanic students took, on average, more remedial courses (2.3), had lower combined SAT scores (859), and lower first year post-secondary GPA (1.2) than most others. [23] Finally, Hispanic students tend to come from poorer, less educated families.[24] It is very interesting to see such a large impact on Hispanic students, especially since African American students still seem to be less privileged in many areas, from academic to family background. These results are also different from previous work in that Hispanics are specifically studied.

In terms of academic ability, the results were suggestive that lower ability students suffer more of a community college penalty. Students with weaker academic backgrounds who start at community colleges are about 11-15% less likely to complete a degree relative to students who start in open access four-year colleges. These students may be less able to navigate the academic environment of higher education, especially the transfer process. Being strategic in course-taking in order to ensure the right courses are taken and able to transfer is imperative to a successful community college process if the goal is a bachelor's degree. Further, as they likely spend more time on remedial coursework and more time on studying in general, the opportunity cost of higher education is greater among this group.

As cost is an ever-increasing component of the college decision process, it is important to consider the net benefit of a community college education as it relates to the pursuit of a bachelor's degree. In 2018-2019, the average total cost for undergraduates was approximately $14,600 at four-year public colleges versus $9,400 at two-year public colleges (NCES, 2019b).[25] That is, by starting at a community college, on average a student can expect to save around $10,400.[26] However, this assumes that a student starting at a community college is able to successfully transfer all credits to the four-year college in order to graduate on time, which may not be the case (Reynolds, 2012). An additional year of coursework essentially wipes out any financial gains from beginning at a community college.[27] Median weekly earnings for someone with a bachelor's degree is $1,248 as compared to $887 for someone with an associate degree, so the additional upfront cost may be outweighed by higher expected future earnings, given that starting at a four-year college provides a higher probability of success (Bureau of Labor Statistics, 2020). However, postsecondary costs vary substantially by region and the cost savings to an individual may be much greater. Further, the opportunity cost of a bachelor's degree is unclear, as labor market conditions are ever changing. Taking on additional risk when the reward is uncertain is difficult. Students also may not be able to perfectly evaluate the future value of earnings relative to the cost of higher education and thus put more weight on lower cost options than is optimal (Dowd and Coury, 2006; Reynolds, 2012). Information about financial aid and loans may especially impact the Hispanic population (Nunez and Kim, 2012).

CONCLUSION

Access to higher education via community colleges is an important research topic for a number of reasons. They provide an alternative, possibly lower cost path towards a bachelor's degree. Without

community colleges, many students would not have access to higher education. However, there are opportunity costs associated with this path.

From the above evidence, it seems that students who start at two-year colleges are less likely to earn a bachelor's degree, indicating a diversion effect. If the labor market gains of higher education are not contingent upon educational attainment, then it may be optimal for some students to not go on to earn a bachelor's degree. However, with increasing needs for bachelor's degrees and the labor market returns to a college degree growing, this may no longer hold.

Among those students who attended a two-year college, 62% transferred to a four-year college, and about 61% of those students completed a bachelor's degree. That is, of the 1,600 that started at a community college, the difficulty transferring impacted almost twice as many students as earning a bachelor's degree eventually did. That students are able to successfully complete a bachelor's degree in similar numbers once transferring has been seen in several previous studies (Alba and Lavin, 1981; Alfonso, 2006; Bowen, Chingos, and McPherson, 2009; Dowd and Coury, 2006; Lee, Mackie-Lewis, and Marks, 1993; Melguizo, Kienzl, and Alfonso, 2011). Alleviating the transfer obstacles for students through institutional policies or articulation agreements may help remove the community college penalty. This is certainly an area for future research.

The results from this paper bolster previous research that suggests starting at a two-year college is still a deterrent for baccalaureate attainment. The penalty seems to have decreased over time, as community college goers are 10% less likely to earn a bachelor's degree. That negative effects still persist, even several decades after this problem was first posed, suggests a need for more transparency around transfer options and help navigating the process for overwhelmed students. In light of the above results, special attention might be given to under-served populations, such as Hispanic students, academically weaker students, and those in middle income brackets, to ensure their success. Caution needs to be taken in widespread free community community college policies, as these may increase the number of people choosing two-year colleges over a four-year college, especially in light of rising tuition costs. Community colleges provide an invaluable asset to local communities, but there is still work to be done as they are not always serving as a stepping stone to the bachelor's degree that so many students seek. Targeted interventions to vulnerable populations could motivate more students to successfully transfer to a four-year program and complete a bachelor's degree. As costs continue to rise and the risk borne to students grows, the effects of higher education policies are of utmost importance.

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ENDNOTES

1. Community colleges, throughout this paper, will refer to non-profit public and private institutions that offer at most an associate degree.
2. In 2019, median weekly earnings among workers with a bachelor's degree was $1,248 (and greater for higher degrees), compared to $887 for those who earned an associate degree and $592 for those with less than a high school diploma (Bureau of Labor Statistics, 2020). Further, unemployment rates in 2019 increased as educational attainment decreased; bachelor's degree earners saw an average unemployment rate of 2.2% compared to 2.7% for associate degree earners and 5.4% for those who did not earn a high school diploma (Bureau of Labor Statistics, 2020).
3. People with greater education levels are less likely to smoke, drink excessively, or use illegal drugs, and are more likely to exercise regularly and access preventative health care such as flu shots and other vaccinations, improving long-term health and raising life expectancies among more educated populations (Cutler and Lleras-Muney, 2006). An additional average year of schooling in a community lowers per-capita police

expenditures by $170 (1996 dollars) (Psacharopoulos, 2006). Lochner and Moretti (2004) find that increased schooling lowers the probability of incarceration and arrest.

4. These estimates are based on lifetime tax revenue generated less government spending on higher education (ie. subsidized tuition and financial aid) and government assistance (ie. Welfare, Medicaid). In terms of state income taxes, college graduates pay over double the amount a high school graduate pays over a lifetime, and over three times as much in federal income taxes (Trostel, 2010).
5. It is important to note that Doyle (2009) compares community college attenders to all four-year college attendees while Long and Kurlaender (2009) compares to only open access four year college attenders.
6. Approximately 750 high schools were drawn with probabilities inversely related to school size, and about 30 students were sampled within each school. Private schools and students from Hispanic and Asian populations were over sampled to ensure adequately sized subsamples.
7. All reported sample sizes are rounded to the nearest 10, as required by the ELS restricted-use agreement with NCES.
8. Open access four-year colleges are defined by the 2010 Carnegie classifications, and generally have no or very inclusive testing policies for admittance.
9. This population is contingent upon the desire to earn a bachelor's degree.
10. Average math score is an indicator of school quality which is expected to impact individual behavior (Konstantopoulous, 2005).
11. This value is the percent of observations correctly predicted; that is the combination of the percent of observations that have propensity scores ($\hat{p}$) greater than the percent of treated individuals that took the treatment and the percent of observations that have propensity scores below the percent of treated individuals that did not take the treatment.
12. Please see Appendix D1-D19 for full results.
13. Results are shown in Appendix Table C1.
14. The number of blocks varies by model. Blocks were chosen to ensure the balancing property was satisfied. This approach is recommended by Rosenbaum and Rubin (1985).
15. I use a caliper of 0.1, meaning that if there is not a propensity score within 0.1 from the treated propensity score, the individual will not be matched. Ties are broken by random draw. I use only one match per observation.
16. Standard errors are bootstrapped in this method, with 200 replications. The bandwidth is set at 0.06.
17. Standard errors are bootstrapped in this method, with 200 replications. The radius was set to 0.1.
18. Note these results are similar, but a bit smaller than the probit results above; this is likely due to the very similar samples.
19. It is possible that just by attending any college in greater numbers, there is a greater democratization effect that outweighs this negative impact (Gonzalez and Hilmer, 2006). However, these students all self-identified as wanting to earn a bachelor's degree, so this impact stands out regardless.
20. Rosenbaum bounds (Rosenbaum, 2002) are used for continuous outcome variables, but as the outcome variable in this case is binary, mhbounds are used.
21. The Stata program 'sensatt' is provided by Nannicini (2007).
22. The percentages for the other racial/ethnic categories were as follows: full-time - White (77%), African American (72%), Asian (73%), first generation - White (19%), African American (21%), Asian (27%).
23. African Americans were the only racial group that was academically weaker than Hispanics with an average of 3.4 remedial courses, combined SAT score of 763, and first-year postsecondary GPA of 1.5. On the other hand, White students took 1.1 remedial courses, earned an average combined SAT score of 971, and had an average first year postsecondary GPA of 2.0, and Asians took an average of 1.5 remedial courses, earned an average combined SAT score of 981, and had an average first year postsecondary GPA of 1.9.
24. 58% of Hispanic families earned less than $50,000 and 33% had parents with at least a bachelor's degree. This is relative to White families where 41% earned less than $50,000 and 45% had parents with at least a bachelor's degree, African American families where 70% earned less than $50,000 and 30% of parents had earned at least a bachelor's degree, and Asian families where 57% earned less than $50,000 and 51% of parents had earned at least a bachelor's degree.
25. These statistics are for first-time full-time undergraduates living off campus with family in 2018-2019. The gap in cost is a bit larger when considering net price instead as community college goers may see better aid packages (NCES, 2019c).
26. This is assuming an average cost for two years of community college and two years of a four-year college. Room and board is not controlled for as this would be a cost a student would face regardless.

[27] In this sample, students in open access four-year colleges took 59 months to complete their bachelor's degree, as compared to 67 months among community college starters. A nine-month difference could be enough to erase any financial incentive to the community college.

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APPENDIX 1: ADDITIONAL SUMMARY STATISTICS

Table A1: School and Geographic Characteristics by Postsecondary Start

	Start 2	Start OA 4	Start 4
	Geographic Characteristics		
Unemployment Rate	5.819	5.747	5.476
	(0.040)	(0.045)	(0.020)
Per Capita Income (2004)	32,904	32,691	35,190
	(213.9)	(265.0)	(135.6)
	High School		
Average Math Score	50.31	50.27	53.33
	(0.115)	(0.151)	(0.075)
Over 50% Peers to Four Year College	0.410	0.496	0.659
	(0.012)	(0.015)	(0.007)
Over 50% Peers to Two Year College	0.133	0.059	0.044
	(0.009)	(0.007)	(0.003)
School: Urban	0.268	0.374	0.367
	(0.011)	(0.014)	(0.007)
School: Suburban	0.542	0.459	0.488
	(0.012)	(0.015)	(0.008)
School: Rural	0.190	0.166	0.145
	(0.010)	(0.011)	(0.005)
School: Public	0.787	0.735	0.623
	(0.010)	(0.013)	(0.007)
	Postsecondary Characteristics		
Postsecondary GPA (1st yr)	1.818	1.888	2.492
	(0.075)	(0.083)	(0.034)
Full-time	0.741	0.848	0.926
	(0.011)	(0.011)	(0.004)
Number Remedial Courses	1.591	1.285	0.407
	(0.060)	(0.057)	(0.016)
Has Student Loan (1:Yes)	0.508	0.619	0.628
	(0.013)	(0.014)	(0.007)
First Generation College Student	0.214	0.195	0.115
	(0.010)	(0.012)	(0.005)
Break from PS	0.647	0.497	0.279
	(0.023)	(0.024)	(0.009)
Delay Postsecondary Attendance	0.141	0.088	0.032
	(0.009)	(0.008)	(0.003)
N	1600	1130	4380

Standard errors in parentheses

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

SUBGROUP DESCRIPTIVES

Table A2: Independent Variables by Race

	White			African American			Hispanic			Asian		
	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4
Gender (1: Male)	0.429	0.474	0.457	0.447	0.464	0.439	0.402	0.409	0.425	0.511	0.483	0.478
Age	18.40	18.40	18.38	18.40	18.25	18.33	18.32	18.39	18.32	18.32	18.27	18.28
Combined SAT Score	971.3	989.4	1120.7	762.6	839.4	972.5	859.3	890.2	1045.0	981.2	950.7	1152.8
Verbal SAT Score	489.9	498.2	560.4	382.2	423.6	488.6	432.9	442.4	517.8	458.3	458.3	547.1
Math SAT Score	481.5	491.1	560.5	380.4	415.8	483.9	426.4	447.7	527.1	522.9	492.4	605.7
Math Score (ELS)	52.41	51.59	56.97	43.55	45.53	51.06	48.57	48.00	54.65	54.27	51.95	59.57
GPA (Weighted, HS)	2.911	2.965	3.359	2.303	2.481	2.911	2.654	2.820	3.244	3.009	2.965	3.549
GPA (PostSec)	2.008	2.095	2.523	1.450	1.786	2.302	1.249	1.489	2.369	1.881	1.388	2.564
Over 50% Peers to 4-Yr	0.457	0.564	0.692	0.288	0.428	0.594	0.345	0.402	0.551	0.314	0.368	0.583
Attended full-time	0.769	0.832	0.928	0.718	0.876	0.911	0.634	0.856	0.913	0.734	0.805	0.924
Remedial Courses	1.148	0.947	0.325	3.418	1.760	0.917	2.289	1.841	0.683	1.468	1.379	0.448
Student Loan (1:Yes)	0.489	0.612	0.613	0.600	0.660	0.756	0.479	0.674	0.700	0.532	0.540	0.598
First Generation Student	0.190	0.172	0.0928	0.212	0.184	0.125	0.289	0.288	0.216	0.266	0.310	0.183
Break from PS	0.616	0.440	0.258	0.706	0.596	0.389	0.825	0.591	0.383	0.569	0.425	0.232
Hours Worked (03-04)	3.226	2.911	2.518	3.341	3.076	2.584	2.851	2.447	2.317	1.915	1.920	1.825
Extracurricular Activities	2.376	2.369	2.999	2.165	2.340	2.749	1.974	2.273	2.540	2.170	2.207	3.094
Delay in PS	0.120	0.079	0.034	0.312	0.120	0.033	0.144	0.076	0.028	0.080	0.092	0.024
N	960	580	3060	170	250	300	190	130	290	190	90	540

Standard errors in parentheses

$p < 0.10$, $p < 0.05$, $p < 0.01$

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table A3: Independent Variables by Income

	< $35,000			$35,000-$50,000			$50,000-$75,000			$75,000-$100,000			> $100,000		
	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4
Gender (1: Male)	0.400	0.393	0.404	0.427	0.509	0.410	0.451	0.482	0.472	0.436	0.435	0.490	0.519	0.500	0.484
White	0.453	0.320	0.466	0.602	0.495	0.670	0.688	0.645	0.726	0.688	0.636	0.769	0.681	0.615	0.781
African American	0.184	0.299	0.151	0.117	0.243	0.075	0.079	0.179	0.060	0.051	0.158	0.060	0.037	0.169	0.032
Hispanic	0.158	0.193	0.120	0.129	0.117	0.069	0.110	0.068	0.055	0.077	0.087	0.054	0.102	0.068	0.048
Asian	0.164	0.118	0.212	0.104	0.0794	0.142	0.0814	0.0359	0.102	0.111	0.0652	0.0833	0.111	0.0676	0.106
Other	0.0416	0.0695	0.0516	0.0485	0.0654	0.0443	0.0420	0.0717	0.0571	0.0726	0.0543	0.0348	0.0694	0.0811	0.0334
Age	18.42	18.34	18.36	18.37	18.40	18.34	18.36	18.31	18.35	18.37	18.33	18.35	18.39	18.37	18.37
Combined SAT	880.2	870.2	1028.0	928.3	943.1	1083.2	951.3	943.3	1108.4	964.6	981.7	1117.2	1000.0	1015.1	1163.1
Verbal SAT Score	433.3	434.3	507.0	471.5	472.3	541.9	478.3	475.9	550.4	479.3	493.7	553.0	500.3	508.0	577.6
Math SAT Score	446.8	435.9	521.7	456.8	470.8	541.3	473.0	467.4	558.0	485.3	488.0	564.3	499.8	507.2	585.5
Math Score (ELS)	48.91	47.04	53.51	50.74	50.71	55.92	52.03	50.60	56.73	52.05	50.71	57.04	53.64	51.80	58.65
GPA (Weighted, HS)	2.757	2.711	3.274	2.782	2.884	3.368	2.860	2.780	3.349	2.862	2.944	3.308	2.886	2.958	3.378
GPA (PostSec)	1.616	1.600	2.462	1.679	1.988	2.445	1.871	1.999	2.378	2.213	2.104	2.493	1.922	1.931	2.624
Over 50% Peers to 4-Yr	0.280	0.417	0.470	0.392	0.383	0.590	0.423	0.538	0.618	0.509	0.598	0.726	0.579	0.642	0.794
Attended full-time	0.683	0.822	0.912	0.735	0.832	0.927	0.761	0.865	0.931	0.791	0.886	0.929	0.787	0.851	0.928
Remedial Courses	2.009	1.538	0.679	1.673	1.355	0.440	1.370	1.339	0.422	1.444	0.951	0.345	1.139	0.939	0.261
Student Loan (1:Yes)	0.530	0.622	0.722	0.550	0.645	0.723	0.509	0.645	0.665	0.517	0.636	0.654	0.389	0.507	0.474
First Generation	0.379	0.393	0.321	0.288	0.187	0.180	0.152	0.108	0.0949	0.0513	0.0924	0.0572	0.0417	0.0405	0.0138
Break from PS	0.641	0.471	0.318	0.738	0.500	0.287	0.630	0.530	0.296	0.611	0.457	0.303	0.602	0.547	0.222
Hours Worked (03-04)	3.055	3.012	2.597	3.094	2.981	2.705	3.089	2.689	2.343	2.970	2.679	2.376	2.708	2.291	2.202
Extracurricular	2.236	2.284	2.750	2.243	2.304	3.093	2.257	2.410	2.893	2.462	2.424	2.905	2.347	2.419	3.070
Delay in PS	0.199	0.112	0.036	0.146	0.098	0.038	0.126	0.072	0.040	0.077	0.065	0.019	0.106	0.074	0.028
N	460	330	720	310	210	650	380	250	980	230	180	800	220	150	1230

Standard errors in parentheses

$p < 0.10$, $p < 0.05$, $p < 0.01$

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table A4: Independent Variables by Math Score

	Math Quartile 1			Math Quartile 2			Math Quartile 3			Math Quartile 4		
	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4
Gender (1: Male)	0.326	0.405	0.310	0.396	0.412	0.369	0.435	0.427	0.413	0.579	0.594	0.516
White	0.391	0.300	0.524	0.593	0.462	0.610	0.674	0.556	0.712	0.680	0.699	0.722
African American	0.305	0.453	0.207	0.127	0.259	0.161	0.039	0.163	0.085	0.021	0.076	0.029
Hispanic	0.190	0.142	0.124	0.125	0.144	0.085	0.109	0.103	0.079	0.082	0.080	0.049
Asian	0.075	0.053	0.083	0.095	0.062	0.090	0.113	0.097	0.085	0.183	0.088	0.157
Other	0.039	0.053	0.062	0.059	0.074	0.053	0.064	0.080	0.038	0.034	0.056	0.043
Age	18.50	18.39	18.40	18.38	18.32	18.41	18.34	18.36	18.35	18.36	18.34	18.35
Combined SAT Score	723.4	735.5	840.1	853.7	855.7	926.2	978.3	981.7	1034.0	1133.7	1141.4	1212.6
Verbal SAT Score	366.7	375.5	448.9	436.0	436.7	478.4	492.5	491.4	520.9	546.6	558.2	590.8
Math SAT Score	356.7	360	391.2	417.7	419.0	448.6	485.8	490.3	513.1	587.1	583.3	621.8
Math Score (ELS)	38.65	37.59	37.92	46.86	45.39	46.06	53.40	52.09	52.82	62.47	61.72	62.66
GPA (Weighted, HS)	2.349	2.323	2.694	2.602	2.631	2.953	2.968	2.952	3.167	3.237	3.317	3.574
GPA (PostSec)	1.470	1.583	1.758	1.670	1.819	2.078	1.985	1.940	2.388	2.038	2.142	2.698
Over 50% Peers to 4-Yr	0.341	0.400	0.497	0.385	0.491	0.544	0.435	0.519	0.643	0.458	0.546	0.706
Attended full-time	0.692	0.774	0.848	0.712	0.844	0.902	0.767	0.868	0.911	0.780	0.880	0.945
Remedial Courses	3.591	2.779	1.841	2.042	1.615	0.993	0.961	0.805	0.460	0.381	0.365	0.145
Student Loan (1:Yes)	0.470	0.600	0.731	0.503	0.624	0.613	0.507	0.650	0.637	0.542	0.582	0.619
First Generation Student	0.269	0.221	0.234	0.242	0.215	0.174	0.208	0.212	0.133	0.146	0.124	0.0826
Break from PS	0.659	0.600	0.476	0.745	0.488	0.365	0.598	0.516	0.321	0.585	0.406	0.222
Hours Worked (03-04)	2.828	2.826	2.228	3.332	2.971	2.773	3.076	2.734	2.679	2.677	2.574	2.168
Extracurricular Activities	2.039	2.232	2.434	2.138	2.356	2.596	2.390	2.390	2.668	2.532	2.406	3.234
Delay in PS	0.208	0.163	0.0966	0.154	0.0853	0.0496	0.118	0.0802	0.0371	0.106	0.0442	0.0202
N	280	190	150	460	340	560	490	350	1350	380	250	2330

Standard errors in parentheses

$p < 0.10$, $p < 0.05$, $p < 0.01$

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table A5: Income and Education by Race

	White			African American			Hispanic			Asian		
	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4
< $35,000	0.215	0.182	0.109	0.491	0.396	0.357	0.371	0.485	0.298	0.397	0.443	0.280
$35,000 - $50,000	0.194	0.182	0.144	0.211	0.208	0.164	0.206	0.189	0.156	0.169	0.205	0.172
$50,000 - $75,000	0.272	0.278	0.233	0.181	0.180	0.193	0.216	0.129	0.187	0.169	0.102	0.185
$ 75,000 - $100,000	0.167	0.202	0.201	0.0702	0.116	0.157	0.0928	0.121	0.149	0.138	0.136	0.124
> $100,000	0.152	0.156	0.313	0.0468	0.100	0.128	0.113	0.0758	0.211	0.127	0.114	0.240
Parent: Less than HS	0.009	0.010	0.003	0.041	0.012	0.010	0.108	0.167	0.087	0.106	0.193	0.063
Parent: HS	0.180	0.161	0.0892	0.175	0.172	0.115	0.180	0.121	0.131	0.159	0.114	0.120
Parent: Some Two	0.119	0.105	0.0697	0.152	0.132	0.0754	0.134	0.129	0.0623	0.0529	0.0909	0.0554
Parent: Two	0.139	0.105	0.0814	0.211	0.108	0.0984	0.113	0.114	0.0796	0.0847	0.0682	0.0498
Parent: Some Four	0.107	0.113	0.0990	0.123	0.160	0.134	0.139	0.144	0.145	0.0899	0.0341	0.0461
Parent: Four	0.263	0.283	0.315	0.211	0.272	0.325	0.201	0.174	0.235	0.302	0.307	0.301
Parent: Master's	0.127	0.148	0.214	0.0409	0.0960	0.141	0.0928	0.0985	0.142	0.148	0.136	0.188
Parent: Doctorate	0.0550	0.0755	0.128	0.0468	0.0480	0.102	0.0309	0.0530	0.118	0.0582	0.0568	0.177
Average ELS Math Score	50.74	51.89	53.65	47.25	47.24	50.61	48.88	48.84	51.68	52.25	50.44	54.05
Urban	0.191	0.269	0.335	0.409	0.496	0.485	0.479	0.568	0.481	0.339	0.477	0.400
Suburban	0.560	0.513	0.490	0.444	0.388	0.410	0.438	0.364	0.439	0.603	0.443	0.550
Rural	0.249	0.218	0.174	0.146	0.116	0.105	0.0825	0.0682	0.0796	0.0582	0.0795	0.0498
Public High School	0.758	0.678	0.576	0.895	0.860	0.672	0.747	0.659	0.612	0.931	0.920	0.860
Unemployment Rate	5.676	5.511	5.422	6.245	5.769	5.641	6.251	6.477	5.885	5.786	6.352	5.551
Per Capita Income (2004)	31620	31948	34413	32059	34868	34925	33853	29709	34847	38847	35031	39397
N	960	580	3070	170	250	310	190	130	290	190	90	540

Standard errors in parentheses

$p < 0.10$, $p < 0.05$, $p < 0.01$

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table A7: Income and Family Background by Math Quartile

	Math Quartile 1			Math Quartile 2			Math Quartile 3			Math Quartile 4		
	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4
< $35,000	0.446	0.489	0.359	0.300	0.309	0.250	0.239	0.274	0.186	0.209	0.149	0.117
$35,000 - $50,000	0.179	0.158	0.207	0.213	0.191	0.151	0.204	0.202	0.158	0.169	0.197	0.141
$50,000 - $75,000	0.186	0.195	0.179	0.235	0.229	0.234	0.255	0.231	0.222	0.265	0.221	0.225
$75,000 - $100,000	0.121	0.105	0.138	0.136	0.165	0.183	0.158	0.165	0.183	0.161	0.205	0.186
> $100,000	0.068	0.053	0.117	0.116	0.106	0.181	0.144	0.128	0.251	0.196	0.229	0.331
Parent: Less than HS	0.057	0.032	0.055	0.040	0.050	0.034	0.027	0.060	0.017	0.027	0.020	0.011
Parent: HS	0.214	0.189	0.179	0.202	0.165	0.139	0.181	0.151	0.116	0.119	0.104	0.072
Parent: Some Two	0.107	0.179	0.090	0.125	0.118	0.076	0.111	0.083	0.078	0.116	0.092	0.057
Parent: Two	0.146	0.116	0.083	0.138	0.118	0.107	0.146	0.120	0.089	0.119	0.060	0.064
Parent: Some Four	0.121	0.147	0.159	0.127	0.138	0.121	0.101	0.114	0.122	0.098	0.108	0.079
Parent: Four	0.239	0.242	0.262	0.228	0.256	0.283	0.249	0.285	0.317	0.310	0.293	0.310
Parent: Master's	0.064	0.063	0.124	0.101	0.091	0.167	0.144	0.137	0.164	0.130	0.217	0.235
Parent: Doctorate	0.050	0.032	0.048	0.040	0.065	0.072	0.041	0.051	0.098	0.082	0.104	0.173
Average ELS Math Score	47.79	46.61	48.96	49.68	49.39	50.71	50.51	50.96	52.51	52.69	53.28	54.71
Urban	0.314	0.432	0.476	0.283	0.429	0.359	0.235	0.362	0.361	0.259	0.273	0.365
Suburban	0.504	0.453	0.414	0.513	0.409	0.472	0.582	0.467	0.487	0.553	0.522	0.498
Rural	0.182	0.116	0.110	0.204	0.162	0.169	0.183	0.171	0.152	0.188	0.205	0.137
Public High School	0.839	0.805	0.676	0.798	0.744	0.678	0.759	0.729	0.616	0.770	0.679	0.610
Unemployment Rate	6.226	5.789	5.766	5.805	5.836	5.597	5.651	5.815	5.482	5.749	5.498	5.425
Per Capita Income (2004)	32536	34366	34311	32492	32895	33785	33118	32117	35072	33397	31942	35655
N	280	190	150	460	340	570	490	350	1350	380	250	2330

Standard errors in parentheses

$p < 0.10$, $p < 0.05$, $p < 0.01$

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table A6: Family Background by Income

	Income < $35,000			$35,000-$50,000			$50,000-$75,000			$75,000-$100,000			> $100,000		
	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4	Start 2	Start OA 4	Start 4
Parent: Less than HS	0.085	0.106	0.075	0.036	0.042	0.026	0.016	0.008	0.003	0.004	0.016	0	0	0	0.001
Parent: HS	0.293	0.287	0.244	0.252	0.144	0.153	0.138	0.100	0.092	0.047	0.076	0.057	0.042	0.041	0.014
Parent: Some Two	0.131	0.157	0.103	0.165	0.135	0.114	0.112	0.108	0.081	0.077	0.065	0.058	0.060	0.041	0.014
Parent: Two	0.144	0.106	0.108	0.171	0.107	0.114	0.133	0.131	0.106	0.141	0.087	0.066	0.079	0.081	0.026
Parent: Some Four	0.101	0.100	0.118	0.139	0.186	0.122	0.117	0.175	0.127	0.103	0.097	0.102	0.093	0.047	0.056
Parent: Four	0.166	0.163	0.219	0.168	0.293	0.251	0.319	0.311	0.334	0.385	0.351	0.360	0.319	0.311	0.332
Parent: Master's	0.050	0.036	0.085	0.052	0.056	0.125	0.125	0.120	0.184	0.188	0.254	0.248	0.241	0.297	0.292
Parent: Doctorate	0.028	0.045	0.047	0.019	0.037	0.096	0.039	0.048	0.073	0.056	0.054	0.118	0.167	0.182	0.265
Average ELS Math Score	48.94	48.37	50.83	49.96	49.41	52.17	50.46	50.63	52.80	51.08	51.82	53.66	52.64	53.22	55.60
Urban	0.313	0.423	0.428	0.274	0.377	0.293	0.217	0.311	0.352	0.248	0.395	0.345	0.278	0.345	0.396
Suburban	0.495	0.426	0.418	0.510	0.447	0.480	0.572	0.454	0.479	0.585	0.465	0.527	0.588	0.554	0.516
Rural	0.193	0.151	0.154	0.216	0.177	0.226	0.211	0.235	0.170	0.167	0.141	0.128	0.134	0.101	0.0877
Public High School	0.880	0.825	0.768	0.803	0.814	0.707	0.796	0.741	0.663	0.709	0.616	0.591	0.634	0.561	0.482
Unemployment Rate	6.191	6.072	5.819	5.810	5.848	5.480	5.722	5.596	5.470	5.573	5.586	5.458	5.481	5.331	5.290
Per Capita Income (2004)	31696	31788	33563	32293	31226	34280	32714	33289	34363	34136	33072	35249	35336	35346	37249
N	460	330	720	310	220	660	380	250	980	230	190	810	220	150	1230

Standard errors in parentheses

$p < 0.10$, $p < 0.05$, $p < 0.01$

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

APPENDIX 2: VARIABLE CHOICE

Table B1: Variable Choice: Hit or Miss Predictions

	Wald χ^2 ratio	Pseudo R^2	Prob(hit)
Demographics	70.25	0.021	60.4%
Parent Background	167.43	0.027	59.9%
Academic Background	205.92	0.030	58.9%
School Characteristics	235.10	0.033	59.7%
Geographic Characteristics[a]	281.86	0.045	60.6%
Geographic Characteristics[B]	562.74	0.087	63.4%
Female	309.75	0.104	63.8%
Male	179.45	0.071	62.2%
White	155.85	0.045	61.2%
African American	60.19	0.093	63.9%
Hispanic	802.62	0.144	68.7%
Asian	37.69	0.078	63.9%
Income < $35,000	54.19	0.046	60.7%
Income $35,000 - $50,000	73.84	0.107	66.1%
Income $50,000 - $75,000	100.80	0.079	65.3%
Income $75,000 - $100,000	216.37	0.096	63.00%
Income > $100,000	115.84	0.092	65.9%
Math Quartile 1	924.84	0.062	58.3%
Math Quartile 2	102.57	0.060	63.7%
Math Quartile 3	85.33	0.075	64.8%
Math Quartile 4	57.02	0.069	62.2%
Low GPA	200.9	0.052	60.8%
High GPA	105.87	0.059	62.9%

Prob(hit) = $\hat{p}_i$ >Pr(Treat) for $i \in (T = 1)$+ $\hat{p}_j$ <Pr(Treat) for $j \in (T = 0)$

a: region/urbanicity, b: census

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

APPENDIX 3: EVIDENCE OF COVARIATE BALANCE

Table C1: Covariate Balancing Indicators: Before and After Matching

BA Attain	Start Two Year	Start OA Four Year	Logit Pseudo R^2	Logit Pseudo R^2	$P > \chi^2$	Median Bias	Median Bias	% lost to Common Support
	Before	Before	Before	After	After	Before	After	After
All	1,130	1,600	0.087	0.004	0.956	4.9	1.9	0.1%
Females	610	900	0.104	0.004	0.993	8.2	2.1	0.7%
Males	520	700	0.071	0.005	0.995	5.0	2.2	0.3%
< $35,000	330	460	0.047	0.005	1.00	6.7	2.0	0.4%
$35,000 - $50,000	220	310	0.110	0.009	0.999	12.3	3.1	0.2%
$50,000 - $75,000	250	380	0.080	0.007	0.999	11.5	2.3	0.8%
$ 75,000 - $100,000	190	230	0.101	0.006	1.000	11.4	2.4	1.7%
> $100,000	150	220	0.092	0.004	1.000	7.4	2.8	1.9%
Math Quartile 1	190	280	0.061	0.006	1.000	12.7	2.8	1.5%
Math Quartile 2	340	460	0.058	0.006	0.997	6.7	2.7	0.4%
Math Quartile 3	350	490	0.075	0.004	1.000	7.8	2.0	0.4%
Math Quartile 4	250	380	0.066	0.003	1.000	8.8	2.1	3.2%
Low GPA	720	1,010	0.052	0.004	0.988	8.2	2.6	1.1%
High GPA	420	590	0.059	0.006	0.991	8.3	1.7	0.3%
White	580	960	0.045	0.004	0.961	10.0	2.1	0.2%
African American	250	170	0.093	0.003	1.000	15.5	1.5	0.0%
Hispanic	130	190	0.144	0.007	1.000	18.8	2.3	6.6%
Asian	90	190	0.078	0.005	1.000	9.6	2.0	5.1%

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

APPENDIX 4: EVIDENCE OF COVARIATE BALANCE, INDIVIDUAL MODELS MATCHED SAMPLES MEAN AND VARIANCE

Table D1: Some Two-Year College vs. Open Access Four Year College
Full Model

	Standardized Difference	Variance Ratio
Gender	-0.107	0.985
White	0.031	0.988
African American	-0.038	0.912
Hispanic	0.070	1.190
Asian	-0.076	0.846
Income	0.011	0.954
$(\text{Income})^2$	0.006	0.953
Parent Education: High School	0.013	1.023
Parent Education: Some 2	-0.023	0.947
Parent Education: 2 Year	-0.016	0.967
Parent Education: Some 4	0.000	1.000
Parent Education: 4 Year	0.032	1.038
Parent Education: MS	-0.021	0.951
Parent Education: Doctorate	-0.014	0.946
Verbal SAT Score	0.015	1.004
Math SAT Score	-0.011	1.281
GPA (Honor's Weighted)	0.045	1.025
Average ELS Math Score	-0.040	0.838
Public High School	-0.009	1.013
Urban	-0.046	0.955
Rural	0.026	1.043
census1	0.052	1.140
census2	-0.020	0.969
census3	-0.074	0.832
census4	-0.053	0.898
census5	0.043	1.111
census6	0.047	1.131
census7	0.059	1.337
census8	-0.034	0.937

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D3: Some Two-Year College vs. Open Access Four Year College
Males Only

	Standardized Difference	Variance Ratio
White	0.112	0.973
African American	-0.123	0.762
Hispanic	0.144	1.521
Asian	-0.072	0.868
Income	0.040	1.031
$(\text{Income})^2$	0.048	1.025
Parent Education BA+	-0.080	0.992
Verbal SAT Score	0.044	0.868
Math SAT Score	0.033	1.218
GPA (Honor's Weighted)	0.083	1.174
Average ELS Math Score	-0.012	0.868
Public High School	-0.118	1.179
Urban	0.000	1.000
Rural	0.011	1.020
census1	-0.071	0.859
census2	0.065	1.124
census3	0.036	1.111
census4	0.013	1.029
census5	-0.051	0.892
census6	0.018	1.043
census7	0.015	1.074
census8	0.000	1.000

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D4: Some Two-Year College vs. Open Access Four Year College
Income $< \$35,000$

	Standardized Difference	Variance Ratio
Gender	-0.075	0.976
White	-0.123	0.992
African American	0.058	1.105
Hispanic	0.024	1.048
Other	-0.011	0.952
Parent Education BA+	0.015	1.019
Combined SAT Score	-0.016	1.423
GPA (Honor's Weighted)	-0.092	0.967
% Peers Attend Four-Year	-0.060	0.856
Average ELS Math Score	-0.042	1.129
Public High School	0.000	1.000
Urban	-0.056	0.959
Rural	0.011	1.018
NE	0.020	1.050
S	-0.022	0.992
MW	-0.117	0.890
Northeast Urban	0.067	1.381
Northeast Suburban	-0.051	0.840
Midwest Urban	-0.086	0.776
Midwest Suburban	-0.040	0.912
South Urban	-0.034	0.924
South Suburban	-0.017	0.975

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D5: Some Two-Year College vs. Open Access Four Year College
Income $35,000-$50,000

	Standardized Difference	Variance Ratio
Gender	-0.097	0.981
White	-0.007	1.003
African American	0.052	1.140
Other	0.047	1.237
Hispanic	0.060	1.151
Parent Education BA+	0.000	1.000
Combined SAT Score	0.039	0.986
GPA (Honor's Weighted)	-0.035	0.920
% Peers Attend Four-Year	-0.042	0.862
Average ELS Math Score	-0.060	0.867
Public High School	0.109	0.862
Urban	-0.099	0.916
Rural	0.114	1.195
NE	0.076	1.181
S	-0.046	0.980
MW	0.113	1.106
Northeast Urban	-0.043	0.755
Northeast Suburban	0.097	1.303
Midwest Urban	-0.093	0.788
Midwest Suburban	0.117	1.305
South Urban	0.085	1.317
South Suburban	-0.125	0.840

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D6: Some Two-Year College vs. Open Access Four Year College
Income $50,000-$75,000

	Standardized Difference	Variance Ratio
Gender	-0.063	0.992
White	-0.051	1.044
African American	0.093	1.374
Other	0.071	1.435
Hispanic	-0.095	0.806
Parent Education BA+	-0.021	0.999
Combined SAT Score	0.119	0.875
GPA (Honor's Weighted)	-0.013	1.056
% Peers Attend Four-Year	-0.029	0.971
Average ELS Math Score	0.047	1.029
Public High School	0.013	0.981
Urban	-0.025	0.967
Rural	-0.050	0.935
NE	-0.045	0.911
S	-0.033	0.982
MW	0.006	1.004
Northeast Urban	-0.016	0.912
Northeast Suburban	-0.028	0.917
Midwest Urban	0.000	1.000
Midwest Suburban	-0.044	0.941
South Urban	0.011	1.045
South Suburban	0.034	1.058

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D7: Some Two-Year College vs. Open Access Four Year College
Income $75,000-$100,000

	Standardized Difference	Variance Ratio
Gender	-0.163	0.985
White	-0.065	1.060
African American	-0.055	0.811
Other	0.000	1.000
Hispanic	0.086	1.353
Parent Education BA+	0.018	0.991
Combined SAT Score	0.145	1.087
GPA (Honor's Weighted)	-0.017	1.104
% Peers Attend Four-Year	-0.077	0.755
Average ELS Math Score	0.160	0.749
Public High School	-0.019	1.018
Urban	-0.068	0.929
Rural	-0.099	0.852
NE	0.045	1.083
S	-0.107	0.941
MW	-0.028	0.978
Northeast Urban	-0.059	0.780
Northeast Suburban	0.093	1.249
Midwest Urban	-0.122	0.692
Midwest Suburban	0.057	1.106
South Urban	0.018	1.072
South Suburban	-0.032	0.951

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D8: Some Two-Year College vs. Open Access Four Year College
Income $> \$100,000$

	Standardized Difference	Variance Ratio
Gender	-0.046	1.006
White	-0.091	1.084
African American	-0.088	0.680
Other	0.057	1.232
Hispanic	0.192	1.893
Parent Education BA+	0.141	0.887
Combined SAT Score	0.019	1.334
GPA (Honor's Weighted)	-0.040	1.182
% Peers Attend Four-Year	-0.174	0.766
Average ELS Math Score	0.005	1.619
Public High School	-0.078	1.051
Urban	-0.051	0.954
Rural	0.147	1.449
NE	-0.068	0.906
S	0.081	1.078
MW	0.076	1.101
Northeast Urban	0.027	1.161
Northeast Suburban	-0.063	0.889
Midwest Urban	0.017	1.050
Midwest Suburban	-0.028	0.941
South Urban	0.000	1.000
South Suburban	0.048	1.083

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D9: Some Two-Year College vs. Open Access Four Year College Math Quartile 1

	Standardized Difference	Variance Ratio
Gender	-0.008	0.995
White	0.081	1.045
African American	-0.091	0.935
Asian	0.087	1.368
Hispanic	-0.062	0.911
Income	-0.060	0.919
$(\text{Income})^2$	-0.080	0.911
Parent Education BA+	-0.118	0.944
Extracurricular Activities	-0.137	0.945
Average ELS Math Score	0.090	1.268
Public High School	-0.040	1.079
Urban	0.000	1.000
Rural	-0.230	0.741
NE	0.067	1.128
S	-0.080	0.967
W	0.119	1.259

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D10: Some Two-Year College vs. Open Access Four Year College Math Quartile 2

	Standardized Difference	Variance Ratio
Gender	0.004	1.002
White	-0.009	1.003
African American	0.007	1.015
Asian	-0.036	0.909
Hispanic	-0.013	0.971
Income	-0.013	1.044
$(\text{Income})^2$	-0.008	0.952
Parent Education BA+	-0.023	0.988
Extracurricular Activities	-0.041	1.071
Average ELS Math Score	-0.106	0.744
Public High School	0.100	0.874
Urban	0.069	1.076
Rural	0.056	1.090
NE	-0.150	0.772
S	0.000	1.000
W	0.191	1.586

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D11: Some Two-Year College vs. Open Access Four Year College Math Quartile 3

	Standardized Difference	Variance Ratio
Gender	0.008	1.002
White	-0.094	1.084
African American	0.022	1.113
Asian	0.026	1.069
Hispanic	0.178	1.732
Income	0.005	1.059
$(\text{Income})^2$	0.012	1.094
Parent Education BA+	0.058	1.019
Extracurricular Activities	-0.050	0.986
Average ELS Math Score	0.046	1.098
Public High School	-0.054	1.072
Urban	0.049	1.067
Rural	-0.203	0.763
NE	0.006	1.012
S	0.004	1.003
W	-0.031	0.957

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D12: Some Two-Year College vs. Open Access Four Year College Math Quartile 4

	Standardized Difference	Variance Ratio
Gender	0.175	0.975
White	0.000	1.000
African American	-0.035	0.804
Asian	0.007	1.011
Hispanic	0.050	1.175
Income	0.166	0.676
$(\text{Income})^2$	0.133	0.722
Parent Education BA+	0.011	0.999
Extracurricular Activities	0.087	1.039
Average ELS Math Score	-0.090	1.094
Public High School	-0.097	1.149
Urban	0.152	1.220
Rural	-0.020	0.969
NE	0.016	1.037
S	0.006	1.004
W	-0.123	0.888

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D13: Some Two-Year College vs. Open Access Four Year College Low GPA

	Standardized Difference	Variance Ratio
Gender	-0.032	1.000
White	-0.020	1.005
African American	0.000	1.000
Asian	-0.030	0.921
Hispanic	0.064	1.147
Income	-0.003	0.899
$(\text{Income})^2$	-0.019	0.919
Parent Education BA+	-0.043	0.983
% Peers Attend Four-Year	0.040	0.697
Average ELS Math Score	-0.022	0.890
Public High School	0.021	0.973
Suburban	-0.006	1.001
Rural	0.008	1.014
NE	-0.003	0.996
S	0.029	1.018
W	-0.061	0.905

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D14: Some Two-Year College vs. Open Access Four Year College High GPA

	Standardized Difference	Variance Ratio
Gender	0.053 1.036	
White	-0.127	1.126
African American	0.010	1.057
Asian	0.052	1.105
Hispanic	0.101	1.430
Income	-0.081	0.988
$(\text{Income})^2$	-0.094	0.976
Parent Education BA+	0.030	1.004
% Peers Attend Four-Year	0.055	0.516
Average ELS Math Score	-0.005	1.065
Public High School	0.046	0.934
Suburban	-0.003	1.001
Rural	0.033	1.049
NE	-0.071	0.814
S	-0.062	0.974
W	0.036	1.050

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D15: Some Two-Year College vs. Open Access Four Year College White

	Standardized Difference	Variance Ratio
Gender	0.038	1.012
Income	0.034	0.884
$(\text{Income})^2$	0.024	0.914
Parent Education BA+	-0.008	0.998
Verbal SAT Score	-0.008	0.931
Math SAT Score	0.023	1.151
GPA (Honor's Weighted)	0.005	0.999
Average ELS Math Score	-0.025	0.824
Public High School	0.069	0.926
Urban	-0.064	0.910
Rural	-0.029	0.968
NE	0.048	1.106
S	0.064	1.034
W	-0.042	0.903

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D16: Some Two-Year College vs. Open Access Four Year College African American

	Standardized Difference	Variance Ratio
Gender	-0.235	1.008
Income	0.173	0.955
$(\text{Income})^2$	0.177	0.918
Parent Education BA+	0.000	1.000
Verbal SAT Score	-0.094	1.235
Math SAT Score	-0.106	0.813
GPA (Honor's Weighted)	-0.146	1.098
Average ELS Math Score	-0.058	0.812
Public High School	-0.080	1.253
Urban	0.048	1.020
Rural	0.034	1.072
NE	0.099	1.314
S	-0.048	1.020
W	0.022	1.070

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table D17: Some Two-Year College vs. Open Access Four Year College Hispanic

	Standardized Difference	Variance Ratio
Gender	-0.249	0.964
Income	-0.040	1.018
$(\text{Income})^2$	-0.041	0.937
Parent Education BA+	-0.108	0.934
Verbal SAT Score	0.275	0.764
Math SAT Score	0.171	0.871
GPA (Honor's Weighted)	0.172	0.575
Average ELS Math Score	0.247	0.837
Public High School	0.058	0.940
Urban	-0.072	0.999
Rural	0.147	1.711
Northeast	0.270	1.795
South	0.035	1.035
West	-0.272	0.934

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

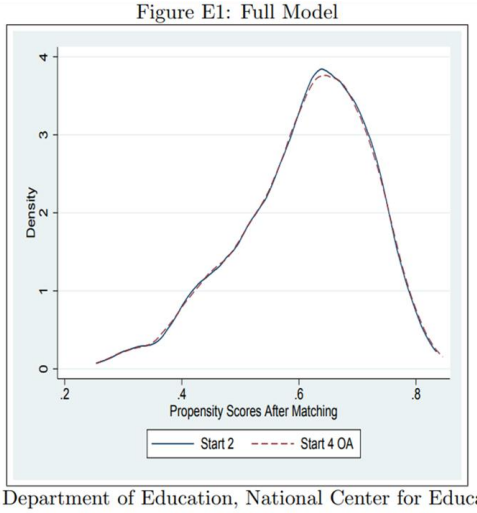
Table D18: Some Two-Year College vs. Open Access Four Year College Asian

	Standardized Difference	Variance Ratio
Gender	0.021	1.000
Income	-0.054	1.007
$(\text{Income})^2$	-0.057	0.951
Parent Education BA+	-0.042	1.003
Verbal SAT Score	-0.094	1.216
Math SAT Score	-0.101	0.918
GPA (Honor's Weighted)	0.069	0.755
Average ELS Math Score	-0.129	0.935
Public High School	0.078	0.782
Urban	-0.131	0.932
Rural	-0.022	0.922
NE	-0.111	0.825
S	0.185	1.486
W	-0.128	1.026

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

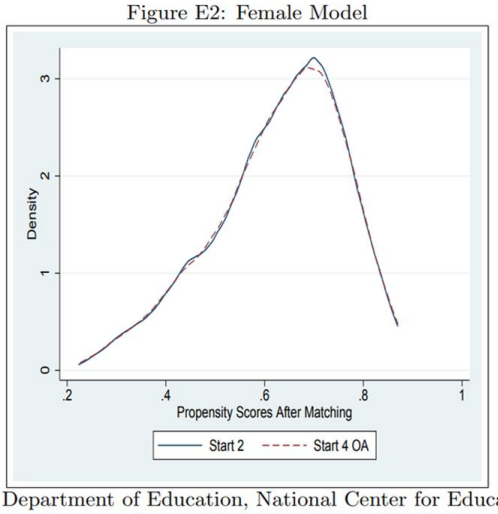
APPENDIX 5: EVIDENCE OF OVERLAP

Figure E1: Full Model



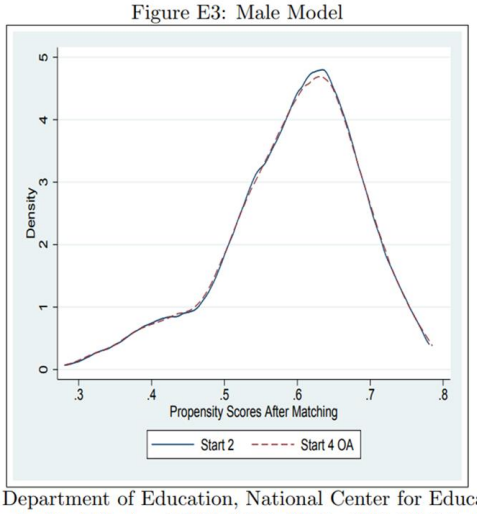
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E2: Female Model



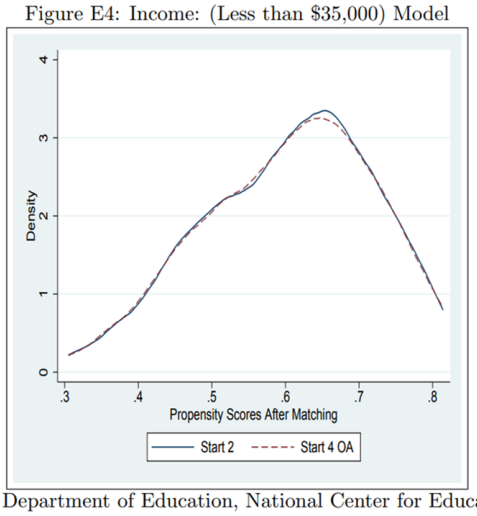
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E3: Male Model



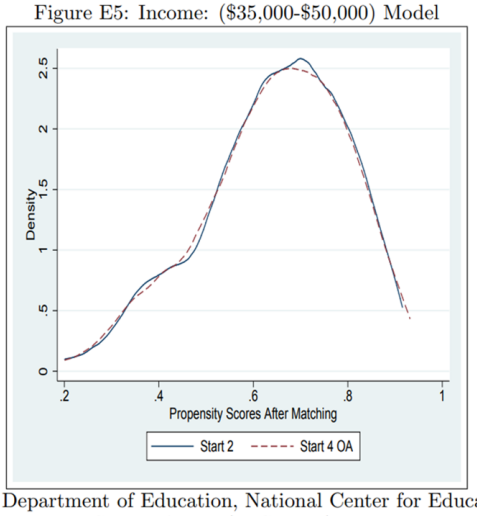
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E4: Income: (Less than $35,000) Model



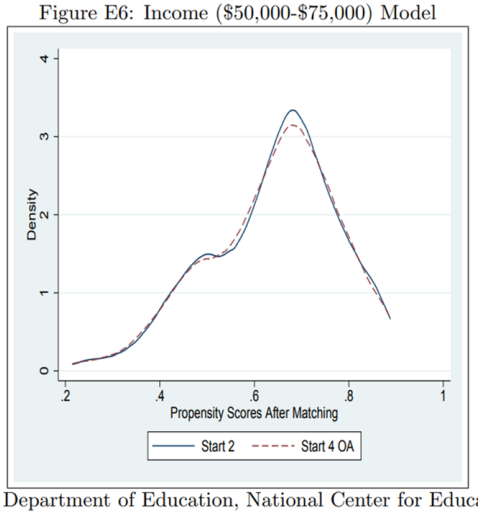
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E5: Income: ($35,000-$50,000) Model



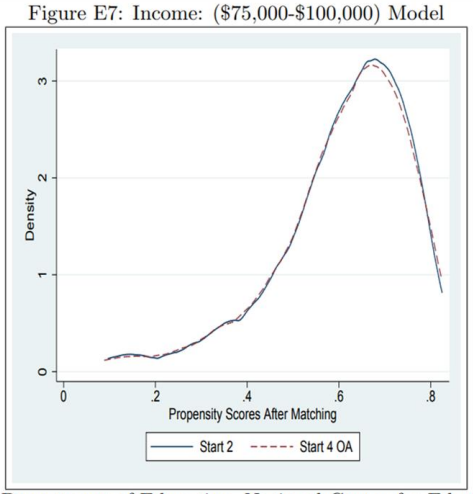
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E6: Income ($50,000-$75,000) Model



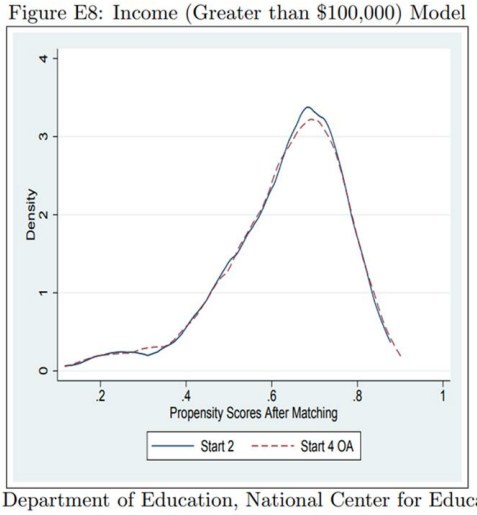
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E7: Income: ($75,000-$100,000) Model



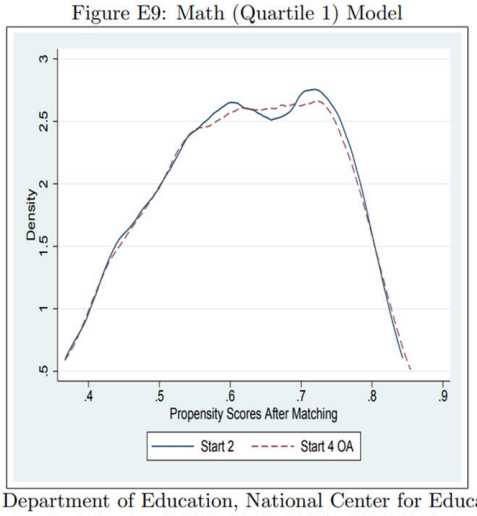
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E8: Income (Greater than $100,000) Model



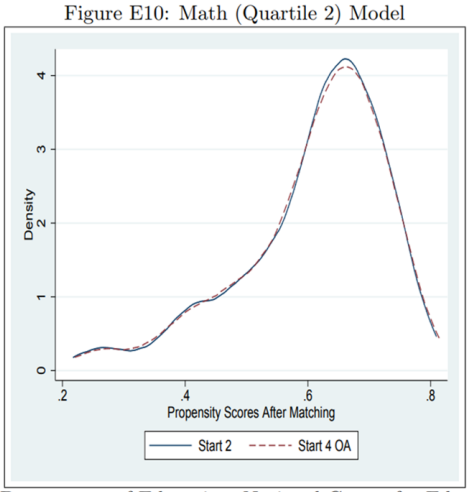
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E9: Math (Quartile 1) Model



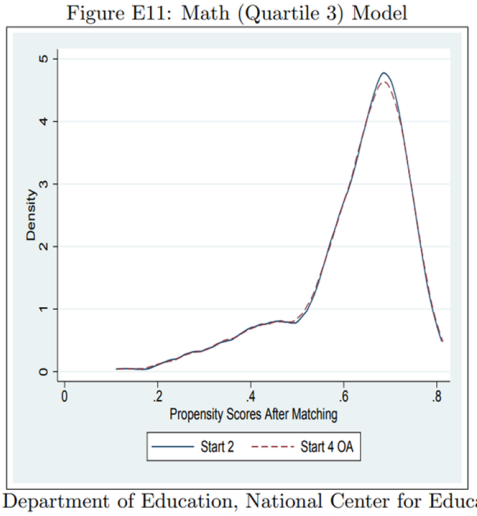
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E10: Math (Quartile 2) Model



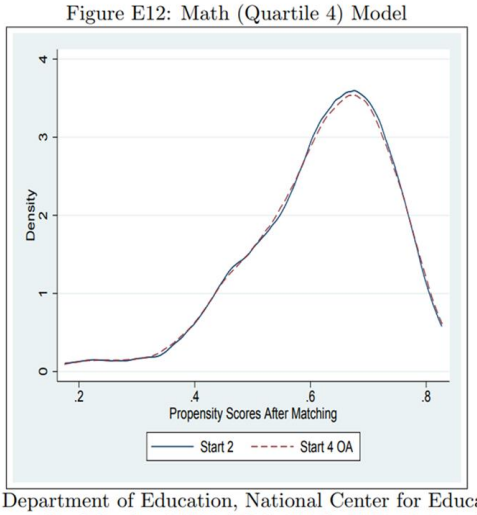
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E11: Math (Quartile 3) Model



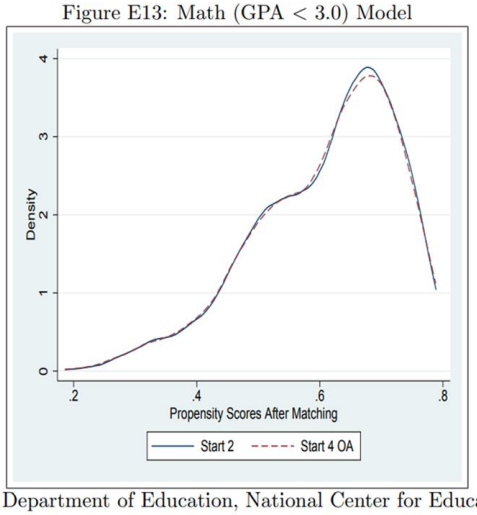
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E12: Math (Quartile 4) Model



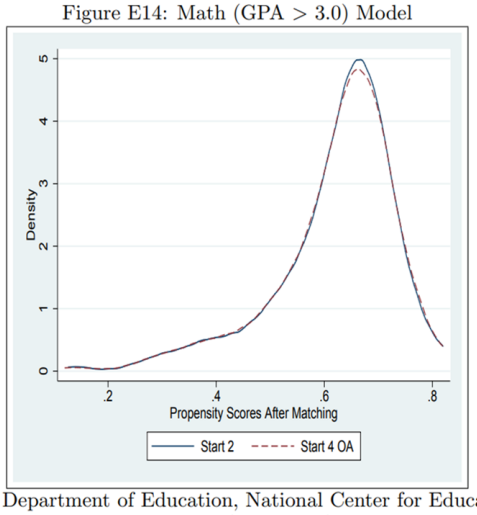
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E13: Math (GPA < 3.0) Model



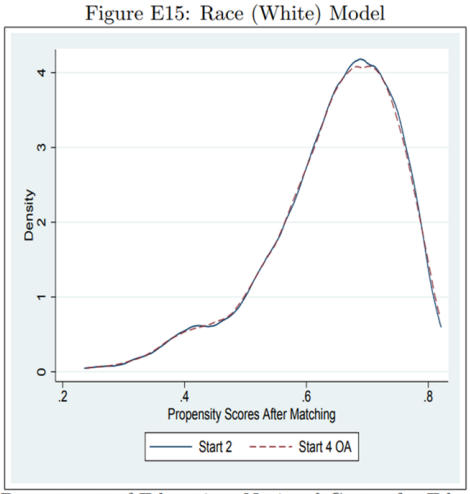
)URCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E14: Math (GPA > 3.0) Model



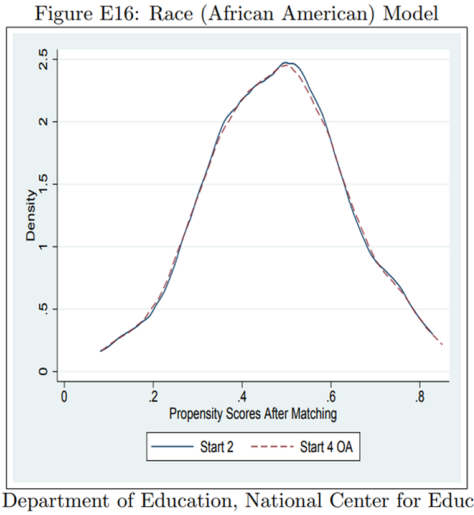
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E15: Race (White) Model



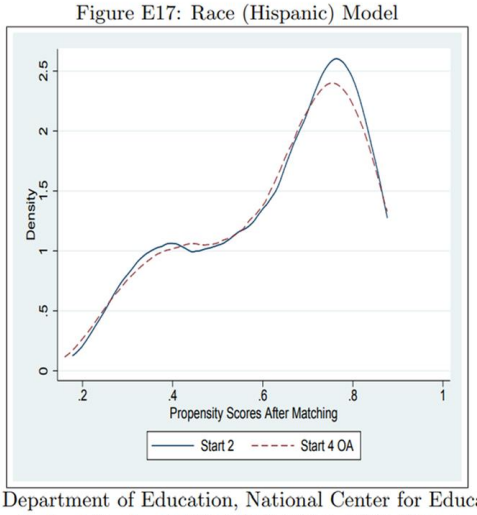
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E16: Race (African American) Model



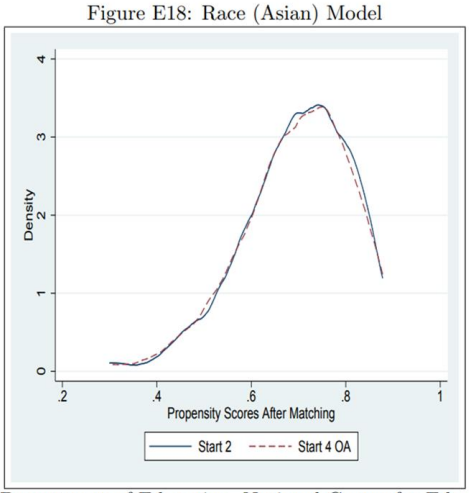
SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E17: Race (Hispanic) Model



SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Figure E18: Race (Asian) Model



SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

APPENDIX 6: SENSITIVITY TEST RESULTS

Table F1: MH Bound Results (5% significance)

	Nearest Neighbor			Stratification		
	Four	Six	BA	Four	Six	BA
Full	1.2	1.3	1.25	1.25	1.35	1.3
Female	1	1.05	1.05	1.1	1.25	1.25
Male	1	1.05	1.05	1.2	1.25	1.2
Income						
< $35K	1	1.3	1	1	1.25	1.15
$35K-$50K	1	1	1	1	1	1.05
$50K-$75K	1	1.1	1	1	1.05	1
$75K-$100K	1	1.05	1.15	1	1.25	1.35
> $100K	1.25	1	1	1.15	1	1
Math						
Math 1	1.3	1	1.35	1	1.1	1.2
Math 2	1.2	1.55	1.25	1	1	1
Math 3	1	1	1	1	1.05	1
Math 4	1.2	1.25	1.3	1	1.15	1.2
Low GPA	1.3	1.4	1.4	1	1.1	1.1
High GPA	1.1	1.15	1.1	1.15	1.25	1.15
Race/Ethnicity						
White	1.05	1.05	1.05	1.1	1.25	1.25
African American	1	1	1	1	1	1
Hispanic	1	1.7	1.35	1	1.85	1.5
Asian	1	1	1.1	1	1	1

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table F2: SENSATT Results - Kernel Matching

	Four Year Degree				Six Year Degree				BA			
d	s	% Explain	Output Effect	Selection Effect	s	% Explain	Output Effect	Selection Effect	s	% Explain	Output Effect	Selection Effect
Full Model												
0.1	-0.3	45.16	1.88	0.28	-0.31	32.98	1.87	0.26	-0.31	31.07	1.80	0.26
0.2	-0.22	54.74	2.96	0.41	-0.24	43.62	2.80	0.36	-0.26	47.57	2.73	0.33
0.3	-0.13	48.39	4.43	0.59	-0.18	46.81	4.25	0.47	-0.20	53.40	4.32	0.43
0.4	-0.04	22.58	7.29	0.84	-0.12	38.30	6.52	0.61	-0.15	50.49	6.54	0.53
Female												
0.1	-0.31	54.84	1.86	0.28	-0.31	33.33	1.85	0.26	-0.31	33.33	1.81	0.26
0.2	-0.22	67.74	2.93	0.40	-0.25	50	3.02	0.35	-0.26	50.93	2.91	0.33
0.3	-0.14	54.84	4.57	0.58	-0.19	48.96	4.46	0.46	-0.21	56.48	4.32	0.41
0.4	-0.05	25.81	7.43	0.82	-0.13	42.71	6.60	0.58	-0.17	54.63	6.61	0.51
Male												
0.1	-0.30	27.03	2.08	0.28	-0.31	33.67	1.94	0.26	-0.31	30.69	1.73	0.26
0.2	-0.21	37.84	3.38	0.41	-0.25	42.86	3.01	0.36	-0.26	49.50	2.89	0.34
0.3	-0.12	27.03	5.14	0.60	-0.18	42.86	4.69	0.48	-0.02	51.49	4.47	0.45
0.4	-0.03	10.81	8.27	0.87	-0.11	32.65	6.96	0.64	-0.14	47.52	7.15	0.56
Academic												
Math Quartile 1												
0.1	-0.31	21.74	4.11e+06	0.27	-0.31	15.96	2.16	0.26	-0.31	20.8	2.20	0.26
0.2	-0.21	19.57	1.58e+07	0.40	-0.23	23.40	4.25	0.39	-0.24	29.6	3.72	0.36
0.3	-0.12	17.39	61.20	0.62	-0.15	21.28	7.18	0.55	-0.17	28	5.58	0.48
0.4	-0.02	4.35	242.09	0.92	-0.06	11.70	12.20	0.79	-0.09	20	9.77	0.67
Math Quartile 2												
0.1	-0.31	23.91	2.09	0.27	-0.31	22	1.98	0.25	-0.31	41.33	1.96	0.26
0.2	-0.22	34.78	3.97	0.41	-0.24	27.33	3.07	0.35	-0.25	54	3.18	0.33
0.3	-0.13	23.91	5.99	0.60	-0.18	25.33	4.74	0.47	-0.19	50	4.86	0.45
0.4	-0.03	6.52	8.8	0.91	-0.11	18.67	7.22	0.63	-0.13	42.67	7.00	0.58
Math Quartile 3												
0.1	-0.3	70.59	1.97	0.28	-0.31	42.65	1.85	0.26	-0.31	51.39	1.90	0.26
0.2	-0.22	88.24	3.13	0.42	-0.25	60.29	3.14	0.36	-0.27	73.61	3.12	0.33
0.3	-0.13	48.82	5.12	0.61	-0.19	57.35	4.52	0.46	-0.22	83.33	4.88	0.39
0.4	-0.04	17.65	7.61	0.87	-0.13	48.53	7.11	0.59	-0.17	69.44	7.15	0.51
Math Quartile 4												
0.1	-0.31	30.26	2.10	0.27	-0.31	38.83	1.98	0.25	-0.32	30.65	1.89	0.25
0.2	-0.23	43.42	3.27	0.36	-0.27	55.34	3.07	0.33	-0.28	52.42	3.22	0.29
0.3	-0.16	42.11	6.17	0.51	-0.22	69.90	5.31	0.38	-0.25	60.48	5.05	0.35
0.4	-0.08	26.32	9.27	0.70	-0.17	59.22	7.50	0.50	-0.21	64.52	8.12	0.42
Low GPA												
0.1	-0.31	32	2.04	0.28	-0.31	29.59	1.86	0.27	-0.31	31.58	1.81	0.26
0.2	-0.21	36	3.33	0.43	-0.24	34.69	2.87	0.38	-0.24	41.23	2.81	0.36
0.3	-0.12	28	5.44	0.62	-0.16	29.59	4.23	0.53	-0.18	41.23	4.23	0.47
0.4	-0.03	4	7.19	0.92	-0.09	18.37	6.46	0.72	-0.12	30.70	6.57	0.61
High GPA												
0.1	-0.30	38.33	1.89	0.27	-0.31	30.91	1.90	0.25	-0.31	34.44	1.86	0.25
0.2	-0.23	53.33	3.21	0.39	-0.27	49.09	3.02	0.31	-0.28	56.67	2.91	0.30
0.3	-0.15	45	4.44	0.53	-0.23	51.82	4.51	0.38	-0.24	66.67	4.43	0.35
0.4	-0.08	28.33	6.99	0.73	-0.18	50	6.98	0.46	-0.21	70	6.88	0.41

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.

Table F3: SENSATT Results - Kernel Matching

	Four Year Degree				Six Year Degree				BA			
d	s	% Explain	Output Effect	Selection Effect	s	% Explain	Output Effect	Selection Effect	s	% Explain	Output Effect	Selection Effect
Income												
Less than $35,000												
0.1	-0.30	21.21	2.23	0.27	-0.31	29.70	1.99	0.26	-0.31	27.62	1.92	0.25
0.2	-0.21	36.36	4.30	0.42	-0.24	37.62	3.11	0.37	-0.25	40.95	3.15	0.36
0.3	-0.12	24.24	6.79	0.60	-0.17	34.65	4.87	0.49	-0.18	41.90	4.91	0.45
0.4	-0.02	6.06	11.96	0.90	-0.09	21.78	7.79	0.70	-0.12	33.33	7.73	0.60
$35,000-$50,000												
0.1	-0.30	57.14	2.68	0.26	-0.31	44.59	2.15	0.27	-0.31	43.12	2.16	0.26
0.2	-0.22	62.86	5.86	0.41	-0.25	58.11	3.59	0.37	-0.25	54.13	3.69	0.34
0.3	-0.13	51.43	8.62	0.61	-0.18	56.76	5.93	0.49	-0.2	50.46	5.41	0.43
0.4	-0.05	20	13.00	0.85	-0.11	39.19	9.02	0.67	-0.15	44.95	9.20	0.56
$50,000-$75,000												
0.1	-0.30	46.15	2.55	0.27	-0.31	50	2.03	0.26	-0.30	120	1.92	0.25
0.2	-0.21	65.38	4.26	0.41	-0.24	72.92	3.30	0.37	-0.25	172	3.16	0.35
0.3	-0.13	50	9.06	0.59	-0.18	70.83	5.22	0.49	-0.19	180	4.90	0.47
0.4	-0.04	19.23	11.76	0.87	-0.11	54.17	8.62	0.66	-0.13	156	7.84	0.59
$75,000-$100,000												
0.1	-0.31	-68.75	2.36	0.27	-0.32	20	1.93	0.23	-0.32	14.89	2.06	0.24
0.2	-0.22	-106.25	5.83	0.41	-0.28	35.29	3.54	0.32	-0.29	27.13	3.59	0.29
0.3	-0.14	-81.25	7.16	0.61	-0.23	37.06	5.44	0.40	-0.25	35.11	6.15	0.34
0.4	-0.05	-37.5	17.06	0.86	-0.18	37.65	9.69	0.49	-0.22	42.55	10.69	0.39
Greater than $100,000												
0.1	-0.31	16.16	2.35	0.26	-0.31	32.67	2.18	0.26	-0.31	23.81	2.17	0.24
0.2	-0.23	28.28	4.79	0.38	-0.26	53.47	4.81	0.34	-0.27	51.43	3.61	0.29
0.3	-0.15	29.29	9.13	0.51	-0.21	60.40	6.39	0.40	-0.23	64.76	7.75	0.36
0.4	-0.08	17.17	15.69	0.74	-0.16	56.44	11.14	0.50	-0.23	67.62	13.73	0.42
Race/Ethnicity												
White												
0.1	-0.31	37.84	1.90	0.28	-0.31	30.61	1.79	0.27	-0.31	33.33	1.82	0.26
0.2	-0.22	54.05	3.07	0.41	-0.25	44.90	2.79	0.35	-0.27	48.15	2.77	0.33
0.3	-0.14	43.24	4.49	0.58	-0.20	46.94	4.52	0.46	-0.22	56.48	4.37	0.40
0.4	-0.06	18.92	7.52	0.82	-0.14	37.76	6.95	0.60	-0.18	52.78	6.98	0.50
African American												
0.1	-0.31	20	3.10	0.27	-0.32	150	2.13	0.27	-0.31	-78.57	1.94	0.26
0.2	-0.22	28	4.97	0.43	-0.24	212.5	2.99	0.40	-0.25	-142.86	3.00	0.38
0.3	-0.13	24	10.35	0.63	-0.17	212.5	5.58	0.57	-0.18	-157.14	5.05	0.55
0.4	-0.04	8	16.14	0.91	-0.09	100	8.25	0.83	-0.12	-128.57	8.32	0.70
Hispanic												
0.1	-0.3	15.38	2.06e+06	0.27	-0.32	5.79	2.89	0.24	-0.31	15.64	2.43	0.24
0.2	-0.21	30.77	2.72e+07	0.42	-0.26	24.79	3.95	0.34	-0.26	30.17	4.76	0.31
0.3	-0.12	30.77	1.94e+07	0.64	-0.19	32.23	7.34	0.47	-0.20	33.52	7.39	0.43
0.4	-0.03	7.69	2.72e+14	0.94	-0.13	23.97	12.84	0.61	-0.15	32.40	12.45	0.50
Asian												
0.1	-0.3	-260	8587.56	0.26	-0.3	47.54	4.37	0.26	-0.31	19.15	3.07	0.24
0.2	-0.21	-280	1792.89	0.41	-0.25	67.21	5.93	0.33	-0.27	50	8.69	0.28
0.3	-0.12	-180	1.93e+08	0.60	-0.19	62.30	26.99	0.43	-0.24	52.13	31.08	0.35
0.4	-0.03	-20	2.85e+24	0.94	-0.14	59.02	23.89	0.56	-0.20	68.09	1968.80	0.39

SOURCE: U.S. Department of Education, National Center for Education Statistics, Education Longitudinal Study of 2002 (ELS: 2002). 2002-2012, including PETS.