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The Impact of Earning an Associate Degree Prior to Transfer on Bachelor's Degree Completion:

A Look at Recent High School Graduates

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Summary

The Impact of Earning an Associate Degree Prior to Transfer on Bachelor's Degree Completion: *A Look at Recent High School Graduates*

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This research brief is the third in a series of four that explore outcomes for recent high school graduates who begin their postsecondary education in a community college. Analyzing national data from the U.S. Department of Education's Education Longitudinal Study (ELS) of 2002 and accompanying Postsecondary Education Transcript Study, this study examined the impact of earning an associate degree prior to transfer on the probability of earning a bachelor's degree. In this study, all students began their postsecondary enrollment in a community college and transferred to a four-year institution. However, some had earned associate degrees before transferring while others had not. Because students self-select into earning or not earning an associate degree, doubly robust estimation for causal inference—a propensity score based technique—was used to estimate less biased and more accurate results.

The results indicate that earning an associate degree prior to transfer neither increased nor decreased the likelihood of completing a bachelor's degree. The full results of the doubly robust model suggest that factors including earning a strong GPA while enrolled in community college and the control and selectivity of the four-year institutions to which students transfer are stronger predictors of bachelor's degree attainment. Additional research will be needed to explore how different types of associate degrees, the major students choose to pursue upon transferring, and different transfer and articulation policies potentially impact bachelor's degree attainment.

Though the key finding of this study indicates that earning an associate degree prior to transfer makes no significant impact on the chances of earning a bachelor's degree, earning an associate degree may still be a wise investment for transfer students. According to one national estimate, between 1994 and 2014, more than 31 million students enrolled in college and left without receiving a degree or certificate (Shapiro et al. 2014). In this study alone, nearly one-third of all students who transferred to a four-year institution had yet to earn either an associate degree or a bachelor's degree 10 years after high school. While some were still enrolled, many had left postsecondary education entirely without a degree. Because more and more jobs are requiring a postsecondary credential, earning an associate degree prior to transfer may be the best strategy to hedge against the prospect of departing higher education without any degree.

This brief concludes with three recommendations for policymakers and practitioners to help increase degree attainment and reduce the proportion of the population with some college, but no degree:

1. Actively promote the economic value of an associate degree to students.
2. Encourage bachelor's degree attainment through comprehensive transfer and articulation policies that incentivize associate degree completion.
3. Establish clear policies for reverse transfer and degree reclamation.

A large and increasing number of students are enrolling in multiple colleges and universities during their postsecondary careers. As a result, a greater focus must be placed on better serving and supporting transfer students across the entire U.S. higher education system. While the associate degree can yield significant economic returns for students on its own, policies and practices must be improved to strengthen the value of an associate degree as a stepping-stone to a bachelor's degree for transfer students.

II. The Research Study

The Research Study

Community colleges serve as an entry point to postsecondary education for hundreds of thousands of students seeking a bachelor's degree each year (Cohen, Brawer, and Kisker 2014; Drury 2003). Because of their open access missions, these institutions can offer students a more accessible and affordable path to earning a bachelor's degree. According to recent data from the National Student Clearinghouse, nearly 270,000 first-time community college students in 2010 transferred to a four-year college or university within six years (Shapiro et al. 2017). This equates to almost 32 percent of all first-time community college students that year.

One key decision prospective transfer students must make is how long to stay at their community college. Should they stay longer, earn an associate degree first, and then transfer? Or should they transfer sooner, having completed some number of transferable courses but not enough to earn an associate degree? Looking again to those 270,000 transfer students, only a third transferred having first earned either a certificate or an associate degree (Shapiro et al. 2017). While there are many potential explanations for why so many students transfer without first earning an associate degree, one potential reason may be a lack of perceived value linked to earning an associate degree when a bachelor's degree or higher is the end goal. While there may limited additive labor market benefits associated with earning both an associate degree and a bachelor's degree, earning an associate degree first may significantly increase the chances a transfer student will earn a bachelor's degree. With only 42 percent of those 270,000 transfer students earning

a bachelor's degree within six years, research is needed to better identify ways to increase bachelor's degree attainment among transfer students.

This study is the third in a series of four briefs that explore outcomes for recent high school graduates who begin their postsecondary education in a community college. The first[1] and second[2] briefs explored predictors of upward transfer and postsecondary credential completion for community college students and made recommendations on ways to improve student outcomes. In this brief, I evaluated the impact of earning an associate degree prior to transfer—compared with transferring without an associate degree—on the likelihood of attaining a bachelor's degree. Because students themselves choose whether to earn an associate degree prior to transfer, I employed a quasi-experimental statistical technique designed to mitigate this self-selection bias and generate more accurate estimates of the potential impact of associate degree completion on bachelor's degree attainment.

Previous Research

A large body of research exists on factors that influence the likelihood of associate degree completion within the community college context. This literature provided insight necessary to identify the independent variables used in this study. For a brief review of that literature, see Turk (2017). What follows now is a review of a growing number of studies that have evaluated the impact of community college enrollment, as well as associate degree completion on the likelihood that students will earn a bachelor's degree.

While community colleges were established, in part, to provide a more accessible path to earning a bachelor's degree, researchers have long been concerned by the possible existence of a "community college penalty." The community college penalty assumption suggests that students who initially enroll in a community college are less likely to complete a bachelor's degree than students who enroll directly in a four-year college or university (Dietrich and Lichtenberger 2015). Research has yielded conflicting answers as to the existence of a community college penalty. Drawing from a number of statistical techniques and data sources, some researchers have found enrolling first in a community college to be associated with a significantly lesser chance of earning a bachelor's degree (Alfonso 2006; Doyle 2009; Long and Kurlaender 2009; Sandy, Gonzalez, and Hilmer 2006). However,

1 http://www.acenet.edu/news-room/Pages/Improving-the-Odds-An-Empirical-Look-at-the-Factors-That-Influence-Upward-Transfer.aspx
2 http://www.acenet.edu/news-room/Pages/Identifying-Predictors-of-Credential-Completion.aspx

these studies tend not to address the fact that not all students who begin at a community college intend to or actually transfer to an institution that offers a bachelor's degree (Dietrich and Lichtenberger 2015). As a result, the negative effects of beginning enrollment in a community college may be overstated.

To address this potential shortcoming, other researchers have compared students who begin their enrollment at a four-year institution with students who begin at a community college and transfer to a four-year college or university. Most often, researchers compare initial four-year enrollees who have achieved junior-level status with transfer students who enter with characteristics that suggest junior-level standing. Many of these studies have found community college transfer students and initial four-year students achieve similar outcomes in terms of retention and completion (Glass and Harrington 2002; Melguizo and Dowd 2009). More recent studies that have employed quasi-experimental techniques—those which aim to reduce the effect of self-selection bias—have also found evidence against the community college penalty (Dietrich and Lichtenberger 2015; Melguizo, Kienzel, and Alfonso 2011; Monaghan and Attewell 2015), though Lichtenberger and Dietrich (2017) did find that community college transfer students may take slightly longer to complete a bachelor's degree than comparable students who began their postsecondary education at a four-year institution.

Similar to this line of research, two recent studies have explored whether earning an associate degree prior to transfer significantly increases the probability of bachelor's degree attainment. Kopko and Crosta (2016) analyzed data from a single community college system using propensity score analysis to compare students who earned around 60 credits and an associate degree with students who earned around 60 credits but no associate degree. All students in their sample transferred to a four-year institution, and the analysis was disaggregated to look for differential effects between earning an Associate in Arts (AA) or Associate in Science (AS) and an Associate in Applied Science (AAS). Kopko and Crosta (2016) found a positive effect associated with earning an AA or AS prior to transfer but no effect for students who earned an AAS.

Wang, Chuang, and McCready (2017) analyzed data from the Beginning Postsecondary Students Longitudinal Study (BPS:04/09) and its accompanying Postsecondary Education Transcript Study (PETS:09). Using both propensity score matching and instrumental variable approaches to address nonrandom assignment, the authors tested whether earning any associate degree prior to transfer significantly impacted the probability of earning a bachelor's degree within six years of first entry into postsecondary education. The results of both the

propensity score and instrumental variable-based models revealed no statistically significant effect. Students who transferred to a four-year institution after first earning an associate degree were no more or less likely to complete a bachelor's degree than students who transferred without an associate degree.

The Study

The purpose of this study was to estimate the effect of earning an associate degree prior to transfer on the probability of attaining a bachelor's degree for students who enrolled first in community college soon after high school. To accomplish this, a sample of 1,690 students who began postsecondary education in a community college and then transferred to a four-year institution was identified using data from the U.S. Department of Education's Education Longitudinal Study of 2002 (ELS) and the corresponding Postsecondary Education Transcript Study. The most frequent year of high school graduation and first postsecondary enrollment was 2004. Students in the sample had until 2014, nearly 10 years after matriculation, to complete a bachelor's degree. Before introducing the quasi-experimental techniques used in this study, it will be helpful to first review the underlying theory behind experimental design in evaluative research.

An experimental design is often considered the gold standard of evaluative research. In true experiments, participants are both randomly selected and assigned to the treatment and control conditions. Random assignment controls for differences in participants' background characteristics, so that any differences observed on the outcome—post-treatment—can be attributed to the treatment itself. Without random assignment, the observed outcome may be the result of an underlying factor unrelated to the treatment under examination. However, true experiments can be very difficult—if not impossible—to conduct in education settings. After all, students are not randomly assigned associate degrees. Rather, they earn them after making a series of conscious decisions to enroll, pursue, and complete the degree. Conventional statistical techniques such as regression fail to consider this underlying problem of nonrandom assignment or self-selection bias. To address the issue of nonrandom assignment, quasi-experimental methods can be used to estimate less-biased causal relationships by simulating random assignment to treatment and control or comparison conditions.

In this study, I used one such quasi-experimental strategy—doubly robust estimation—to evaluate the impact of earning an associate degree prior to transfer—relative to transferring without an associate degree—on bachelor's degree attainment. Doubly robust estimation builds on the propensity score

approach of Rosenbaum and Rubin (1983) and the inverse probability weighting approach of Robins, Hernan, and Brumback (2000) to generate less-biased estimates. To implement this method, I first identified a series of observable characteristics—such as students' race, gender, socioeconomic status, and pre-college academic preparation—likely to predict whether students in the sample would earn an associate degree prior to transfer. Using a probit regression model, I estimated the probability of earning an associate degree prior to transfer as a function of these observable characteristics for each student in the sample. These estimated probabilities are referred to as propensity scores. Next, I converted the propensity scores into sampling weights following a procedure outlined in Guo and Fraser (2015) and Ridgeway et al. (2016) to estimate the average treatment effect on the treated (ATT). The sampling weights are applied in order to reduce baseline differences—differences in observable characteristics like race, high school academic performance, and others—between students who earned an associate degree prior to transfer (treatment group) and students who transferred without an associate degree (comparison group).

Using the sampling weights, I then estimated a second probit regression model in order to evaluate the impact of earning an associate degree prior to transfer on bachelor's degree attainment, while controlling for both the variables used to estimate the propensity scores and a second set of variables that measured select characteristics of the students' first four-year institutions. The results of the weighted probit regression model, presented as marginal effects, show how earning an associate degree prior to transfer and each independent variable in the model impacts the probability of attaining a bachelor's degree. It does this while reducing bias associated with the nonrandom assignment of associate degrees to students. A full discussion of the methods and variables used in this study, including an expanded discussion on causal inference and model specification, is presented in the appendix.

III. Study Findings

Study Findings

Table 1 provides a summary of the key findings of this study. The results of the doubly robust model indicate that earning an associate degree prior to transfer had no statistically significant impact on the probability of earning a bachelor's degree for students in this direct from high school sample. Regardless of whether or not a student earned an associate degree prior to transfer, the probability of completing a bachelor's degree was approximately 64 percent. The lack of evidence of a causal link between associate degree completion and bachelor's degree attainment suggest other factors more strongly predict bachelor's degree attainment. However, if earning an associate degree prior to transfer does not increase the chances of earning a bachelor's degree, what characteristics or factors do?

Table 1. Key Findings

	Doubly Robust Estimation
Earned an Associate Degree Prior to Transfer	
Marginal Effect	-0.000
	(0.035)
Predicted Probability for Treatment Group (Associate Degree)	0.642
Predicted Probability for Control Group (No Associate Degree)	0.642
N =	1,200

+p < .10 *p < .05 **p < .01 ***p < .001
Robust standard errors in parentheses. Per Institute of Education Sciences guidelines, unweighted sample sizes were rounded to the nearest 10.

Table 2 presents the full results of the doubly robust probit regression model, presented in terms of marginal effects. Again, it is important to remember that the doubly robust estimation weighted the sample in order to reduce baseline differences between students who earned an associate degree prior to transfer and those who did not. Given that, seven factors in the model were found to have a statistically significant impact on bachelor's degree attainment.

Table 2. Full Results of the Doubly Robust Probit Regression Model

	Marginal Probability Effect
Associate Degree	-0.000
	(0.035)
Female	0.032
	(0.037)
African American	0.097
	(0.062)
Asian/Pacific Islander	0.036
	(0.057)
Hispanic	-0.058
	(0.056)
Other/Multiple Races	0.014
	(0.084)
Socioeconomic Status	-0.009
	(0.030)
Dual Enrollment	-0.075
	0.058
AP Exam (3 or Better)	0.034
	(0.077)
Algebra II	0.006
	0.056
HS GPA	0.069+
	(0.039)
Entrance Exam	0.084+
	(0.044)
Ed. Expectations (< 4 year degree)	-0.248
	(0.166)
Ed. Expectations (4 year degree)	-0.175
	(0.151)
Ed. Expectations (graduate degree)	-0.257
	(0.157)
Ed. Expectations (don't know)	-0.320+

	(0.163)
Delayed Enrollment	-0.079
	(0.064)
Out of State Enrollment	-0.008
	(0.083)
Developmental English/Math in First Year	0.010
	(0.046)
Academic Advising	0.012
	(0.028)
Extracurricular Activities	-0.044
	(0.039)
Enrolled Exclusively Full-Time at First Institution	0.08
	(0.057)
GPA at First Institution	0.246***
	(0.035)
Credits in First Year	-0.000
	(0.002)
Total Number of Developmental Courses Taken	-0.007
	(0.009)
Ever Received a Pell Grant	-0.111**
	(0.039)
Selectivity of First Four-Year Institution	0.073**
	(0.024)
Control of First Four-Year Institution: Private	0.068
	(0.045)
Control of First Four-Year Institution: For-Profit	-0.203*
	(0.091)
First Four-Year Institution Different State	-0.064
	(0.055)
Pseudo R^2	0.160
N =	1,200

Notes:
+p < .10 *p < .05 **p < .01 ***p < .001
Robust standard errors in parentheses. Per Institute of Education Sciences guidelines, unweighted sample sizes were rounded to the nearest 10.

The GPA that students earned at their first institution prior to transfer to a four-year institution was found to be both highly significant and impactful on the probability of completing a bachelor's degree. With each one-point increase in GPA, the probability of attaining a bachelor's degree increased nearly 25 percentage points. In addition to GPA, students who received a Pell Grant at any time during their postsecondary enrollment were approximately 11 percentage

points less likely to attain a bachelor's degree than students who did not. However, attending a more selective four-year institution after leaving the community college was associated with a higher probability of bachelor's degree attainment. The institutional selectivity measure was constructed by the Department of Education and based on students' test scores. The measure was coded into four levels: not classified or open access, inclusive, moderately selective, and highly selective. Each one-level increase in the selectivity of the four-year institution students transferred to resulted in a 7.3 percentage point increase in the probability of attaining a bachelor's degree. Finally, students whose first four-year institution was a for-profit college or university were around 20 percentage points less likely to attain a bachelor's degree than students who attended a public institution—the reference category. No significant difference in probability was found between students who attended private not-for-profit institutions, relative to public institutions.

Three factors were found to be marginally significant. First, a positive relationship was found between high school GPA and bachelor's degree attainment. Each one-point increase in high school GPA resulted in a nearly 7 percentage point greater probability of attaining a bachelor's degree. Next, students who completed a college entrance exam while still in high school were 8.4 percentage points more likely to attain a bachelor's degree than students who did not. Finally, students who were unsure of their educational expectations during their senior year of high school were nearly 32 percentage points less likely to attain a bachelor's degree relative to students who had expected to earn only a high school diploma—the reference category. In short, students who were unclear about their educational expectations while in high school completed bachelor's degrees at lower rates. No other variables in the model were found to be statistically significant.

Discussion

After mitigating the self-selection bias inherent in who earns associate degrees, the effect of earning an associate degree prior to transfer on the probability of attaining a bachelor's degree was not statistically significant for students who matriculated soon after high school. Though this study focused on recent high school graduates and expanded the potential time in which a student could earn a bachelor's degree from six years to almost 10 years, the overarching results support the findings of Wang, Chuang, and McCready's (2017) analysis of the BPS:04/09 data. Given this finding, two questions remain. First, why is there no statistically significant effect? Second, if the associate degree does not significantly increase the chances of earning a bachelor's degree, what other factors do?

The lack of a statistically significant effect may be due to differences in students' major or field of study after transferring. Perhaps, earning an associate degree prior to transfer has a stronger effect on bachelor's degree attainment for students pursuing majors in one field over another. Because the effect could not be disaggregated by the major students pursued while at their four-year institutions, additional research will be needed to explore potential differences by the major. Additionally, the different types of associate degrees (AA, AS, and AAS) may also yield potentially different results. Additional analysis will be needed to test for potential differential effects by associate degree type using national data.

Similar to what Wang, Chuang, and McCready (2017) posited, the lack of a statistically significant result could also be due to the heterogeneity among transfer and articulation policies across the U.S.[3] These policies can help promote the value of an associate degree as a stepping stone toward a bachelor's degree and incentivize students to earn the associate degree before transferring. In fact, some states have policies, such as a guaranteed transfer of an associate degree, that guarantee students junior-level standing and limit if not exempt them from completing any further general education courses at the receiving institution. Such policies intend to reduce time and money spent by the student at the receiving four-year institution. Other states have policies that attempt to make it easier for students to identify courses at the community college that will transfer, therefore supporting upward transfer without necessarily incentivizing the completion of an associate degree first. And still, some states have little to no formal statewide policies aimed at facilitating transfer and articulation, let alone ones that incentivize earning an associate degree prior to transfer. Disaggregating the data and analysis by state may show earning an associate degree prior to transfer to be beneficial in some states but not others—something that could not be accomplished given limitations of the ELS data.

Additionally, community college students who plan to earn a bachelor's degree may not view an associate degree as a worthwhile investment since they can generally transfer without one. This may be the case both in the presence or absence of policies aimed at incentivizing associate degree completion prior to transfer. Again, in this study, I compared students who had similar levels of academic preparation, similar demographic characteristics, and who, on average,

3 For a comprehensive review and comparison of the transfer and articulation policies across the U.S., see Anderson (2016).

achieved similar levels of academic success at their community college prior to transfer. Essentially, they differed only by the fact that some had earned an associate degree while others had not. Students who completed multiple credits and earned a strong GPA while enrolled in community college likely possess the similar skills, motivations, and sense of determination needed to earn a bachelor's degree, regardless of whether or not they decided to first earn an associate degree. Because of this, the effect of earning an associate degree prior to transfer may have been washed out by these factors and other circumstances once the student enrolled at a four-year institution.

The full results of the doubly robust model suggest that a combination of student-level characteristics and the characteristics of the receiving four-year institution are more significant predictors of bachelor's degree attainment than the student having earned an associate degree prior to transfer. Earning a higher GPA while at the community college significantly improved the chances of earning a bachelor's degree regardless of earning an associate degree prior to transfer. Receiving a Pell Grant, a proxy for socioeconomic status, suggests that students at the lower end of the socioeconomic distribution face greater challenges to bachelor's degree attainment than students at the higher end. Furthermore, students who transferred to more selective institutions were found to have a greater chance of earning a bachelor's degree than students who attended more moderately or less selective institutions. This may be due to 1) more selective institutions admitting only the most prepared or academically successful transfer students, 2) more selective institutions having a greater amount of resources needed to support transfer students, or 3) a combination of these two factors.

Finally, the results suggest that students who transferred to a for-profit four-year institution were substantially less likely to earn a bachelor's degree than students who transferred to a public institution. No statistically significant difference was found between students who transferred to a public four-year institution and those who transferred to a private not-for-profit institution. Nationally, graduation rates at four-year for-profit institutions are considerably lower than those at public and private not-for-profit institutions (U.S. Department of Education 2016). The negative effect associated with transferring to a for-profit four-year college or university could be the result of a variety of factors. While for-profit institutions often enroll a large proportion of students most at risk of dropping out (e.g., low-income students, first-generation students, and students of color), the disparities in completion rates by sector may also be due to differences in educational delivery methods, student support services, and financial aid at for-profit institutions relative to not-for-profit institutions.

IV. Recommendations

Recommendations

The transfer function of America's community colleges plays an important role in the U.S. higher education system. Community colleges provide students with opportunities to earn valuable certificates and associate degrees, as well as a more accessible and often affordable path to earning a bachelor's degree. However, research has shown that while about 80 percent of beginning community college students intend to earn a bachelor's degree (Horn and Skomsvold 2011), only about 32 percent transfer to a four-year institution and only 13 percent earn a bachelor's degree within six years (Shapiro et al. 2017). In the sample analyzed in this study, around one-third of all students who transferred to a four-year institution had yet to earn either an associate degree or a bachelor's degree 10 years after high school. While some were still enrolled, many had left postsecondary education entirely without a degree.

Though the results of this study suggest earning an associate degree prior to transfer does not significantly increase a student's chances of attaining a bachelor's degree, it does nothing to harm their chances either. Because more and more jobs are requiring a postsecondary credential, earning an associate degree prior to transfer may be the best strategy to hedge against the prospect of departing higher education without any degree. In light of the key findings of this study, I offer three recommendations for policy and practice.

1 Actively promote the economic value of an associate degree to students.

College graduates earn more over their lifetimes, are more active in their communities, contribute more in taxes, and generally lead healthier lives than individuals with education at or below the high school level (Ma, Pender, and Welch 2016). Furthermore, an increasing segment of the labor market is requiring workers to have some level of postsecondary education. While information about the benefits of higher education broadly is important, students and their families need to be equipped with accurate information that communicates the value of a variety of postsecondary awards—not just the bachelor's degree.

According to one study, students who earn an associate degree can expect on average to earn anywhere between $4,640 and $7,160 per year more than students who enrolled in college but left without completing a credential (Belfield and Bailey 2017). Carnevale, Jayasundera, and Gulish (2016) found that around 99 percent of all jobs created since the Great Recession have gone to those with education beyond the high school level, with 27 percent going to individuals with associate degrees or some college. Furthermore, in exploring the economic opportunity for workers without bachelor's degrees, Carnevale et al. (2017) found that "good jobs"—those that pay on average $55,000 per year and do not require a bachelor's degree—are increasingly going to individuals with associate degrees. Between 1991 and 2015, the proportion of good jobs held by individuals with associate degrees increased by 83 percent, while individuals with only a high school diploma saw a decline of 8 percent during the same time period. As the price of a college education continue to rise, it easy to understand why more and more individuals are asking the question, "Is college still worth it?" However, a look at the data continues to show that a college education remains an excellent investment.

Working together, high school counselors, teachers, and college and university staff must continue to communicate to students and their families the benefits—both economic and noneconomic—associated with a college education. Furthermore, "higher education" should not be used as shorthand for earning a bachelor's degree. Students need to know that there are a variety of postsecondary paths and credentials that can lead to steady and well-paying employment. In short, students need good information about the value of certificates and associate degrees as well as information about the value of bachelor's and graduate degrees. This will require expanding career exploration opportunities for students both while in high school and once enrolled in college to more comprehensively consider the multitude of postsecondary options.

At the community college level, academic advisors should encourage students planning to transfer to complete an associate degree. It is understandable that some students may question the value of earning an associate degree if their goal is to ultimately transfer and complete a bachelor's degree. However, national statistics show that the majority of community college students who say they want to earn a bachelor's degree, ultimately do not (Jenkins and Fink 2015). While national averages mask the individual circumstances of each prospective transfer student, academic advisors should still promote both the independent value of an associate degree as a postsecondary credential and its value as a form of insurance against the prospect of having to leave college before earning a bachelor's degree. In short, leaving college with an associate degree rather than leaving college with neither an associate nor a bachelor's degree will increase the likelihood that the student will be able to maximize the economic benefits associated with higher education.

2 Encourage bachelor's degree attainment through comprehensive transfer and articulation policies that incentivize associate degree completion.

Effective transfer and articulation policies help students minimize the loss of credit when moving from one institution to another. These policies help students understand which credits will transfer and how those credits will be applied, ideally reducing the number of courses students must retake once at the receiving institution. Instituting clear transfer policies that reduce credit loss can significantly help boost bachelor's degree attainment among transfer students.

Again, the lack of statistical significance found in this study between earning an associate degree prior to transfer and bachelor's degree attainment may have been, in part, due to differences in transfer and articulation policies across the U.S. In the study by Kopko and Crosta (2016), where the authors found a positive effect, the authors analyzed student data from one state that operated under a statewide articulation agreement—a guaranteed transfer of an associate degree type policy. In that state, a clear incentive was established to encourage students to earn an AA or AS degree prior to transfer by guaranteeing students junior-level standing upon transfer. In states without such an articulation policy, students may be incentivized not to complete an associate degree if it means earning additional credits that will not be accepted by the receiving four-year institution.

State policymakers and higher education systems should continue to work together in order to create and promote clear policies that foster persistence and support bachelor's degree completion. Community colleges and four-year institutions should work cooperatively to promote seamless transfer policies that reduce credit loss and encourage students to complete an associate degree prior to transfer. Incentivizing associate degree completion must mean more than just telling students to earn the degree. Rather, institutions will need to facilitate reviews of policies and curricula at both community colleges and four-year institutions to make sure students can complete both degrees in a standard amount of time. Faculty across both types of institutions will need to be engaged to review and consider student learning outcomes for courses, assessment strategies, and instructional rigor to improve program alignment and reduce credit loss in the transfer process. Policymakers should consider providing additional financial support to assist institutional administration and faculty in evaluating existing transfer and articulation policies. These resources will be needed to facilitate interinstitutional collaboration in designing and implementing clearer pathways for transfer students. Furthermore, policymakers must seek input and work alongside institutional leadership and faculty when considering implementing any statewide transfer and articulation policies.

3 Establish clear policies for reverse transfer and degree reclamation.

The National Student Clearinghouse reports that between 1994 and 2014, more than 31 million students have enrolled in college and left without receiving a degree or certificate (Shapiro at al. 2014). Among college students in this study's sample, around one-third had yet to earn any degree nearly 10 years after high school. While some students had only earned a few college credits, others left with more credits than are typically required to earn an associate degree. More states and higher education systems should develop reverse transfer and degree reclamation processes to ensure students who have met the requirements to earn an associate degree receive one. Having a degree will help more individuals capitalize on the economic benefits associated with higher education.

Two multistate efforts, Project Win-Win and Credit When It's Due, through different approaches, have helped thousands of students convert their college credits into an

associate degree. Credit When It's Due promotes reverse transfer policies that allow current four-year students who transferred from a community college to complete the credit requirements for an associate degree while pursuing a bachelor's degree. In effect, transfer students can earn an associate degree en route to earning a bachelor's degree without having to reenroll in a two-year institution. The Project Win-Win model mines student-level data to award associate degrees to former students from associate degree-granting institutions who left higher education with 60 or more credits but no degree. Furthermore, students who left higher education fewer than 12 credits short of an associate degree are contacted and encouraged to reenroll and complete the degree. For a comprehensive overview of Project Win-Win and Credit When It's Due, as well as a discussion on how to bring these programs to national scale, see Wheatle et al. (2017).

Conclusion

While earning an associate degree prior to transfer did not significantly increase the chances that students in this study would attain a bachelor's degree, it also did not significantly lower their chances. Because community college transfer students face many barriers to persistence, a significant portion leave postsecondary education having earned neither a bachelor's nor an associate degree. Across all sectors and levels of American higher education, a greater focus must be placed on better serving and supporting transfer students. Policies and practices must be changed to limit credit loss and to strengthen the value of an associate degree in the pursuit of a bachelor's degree. Prospective transfer students should be encouraged to earn an associate degree not only because such a degree can improve their lifetime economic circumstances, but also because it can significantly reduce the time and resources needed to complete a bachelor's degree. The higher education system must do more to guarantee the latter.

V. Additional Resources

Additional Resources

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VII. Appendix: Methods

Appendix: Methods

Data for this study came from the Education Longitudinal Study of 2002 (ELS), a nationally representative study of 10th grade students in 2002. The sample was constructed by randomly selecting 10th grade students from more than 700 randomly selected high schools across the United States, yielding an initial sample of approximately 16,200 students. In addition to the original baseline data collected in 2002, data were collected in 2004, 2006, and 2012, and postsecondary transcript data were collected in 2014. While it is important to note that these data are not a representative sample of all community college students, ELS provides the most recent and complete data for researchers interested in exploring the connections between high school and other pre-college factors and postsecondary persistence and degree completion.

The population of interest in this study was students who enrolled in a community college directly after high school and subsequently enrolled in a public, private, or for-profit four-year college or university. Community colleges were defined as any public college that offered an associate degree as its highest award. This would therefore exclude students enrolled at institutions that predominately award associate degrees and certificates, but that also offer bachelor's degrees. The initial sample was created by first identifying and removing the 4,570 students without a postsecondary transcript record. Next, the sample was restricted to students whose first postsecondary institution was a community college. A student's first institution was defined in such a way to exclude dual enrollment institutions or institutions students were enrolled in while still in high school. This yielded 4,160 students.

From there only students who subsequently enrolled in a four-year institution were kept. This resulted in a final sample of 1,690 students.

The outcome variable in this study—bachelor's degree attainment—was constructed by examining postsecondary transcript records to identify any student in the sample who had earned a bachelor's degree by 2014. The treatment or independent variable of interest measured whether or not the student had earned any associate degree prior to transferring from his or her first postsecondary institution. The comparison condition was defined as having transferred to a four-year institution without first earning an associate degree. The remaining variables used in this study were used to reduce baseline differences between students in the treatment and comparison conditions, and as independent variables in the doubly robust models. These variables are defined in Table A1.

Associate degrees were not randomly assigned to students, since students choose whether to complete the degree. To address the issue of selection bias and to estimate a less biased causal relationship, propensity score modeling was used to estimate the average treatment effect on the treated (ATT)[4]. The ATT is an estimate concerned with the average impact of a treatment or intervention on individuals who actually receive the intervention. Said another way, the ATT measures the difference in the outcome between individuals assigned to treatment and individuals who were assigned the control or comparison condition but who had a similarly high probability of receiving treatment; that is, a similar propensity score.

Propensity score modeling assumes that treatment assignment and selection are fundamentally based on observable characteristics and factors (Rosenbaum and Rubin 1983). These observables are the factors that are influential in determining participants' probabilities of receiving treatment or control. Formally, a propensity score is defined as the conditional probability of receiving treatment given observable pre-treatment characteristics (Rosenbaum and Rubin 1983). A propensity score is represented by the following equation:

$$e(\chi) = Pr(Z_i = 1 \mid X_i)$$

4 For a full discussion on ATT, the preference of estimating ATT for policy evaluation, and other forms of treatment effect see Heckman (1992; 1996; 1997; 2005).

where e(x) is the probability of receiving treatment (Z_i=1) given a set of theoretically informed covariates X_i. Logit or probit regression procedures are standard techniques by which these probabilities or propensity scores are estimated. A probit regression model was used in this study to estimate the predicted probability of receiving treatment given the factors such as race, sex, academic preparation, college GPA, etc. The variables used in the estimation of propensity scores are denoted in Table A1.

Given that propensity scores can take an infinite value, one method to utilize its statistical power is to rely on matching mechanisms (Rosenbaum and Rubin 1983). Here, conditional on value of the propensity scores, the observables become balanced—that is, statistically significant differences on the observables between individuals in the treatment group and control group are eliminated after matching.[5] In this study, for the propensity score matched model, nearest neighbor matching with replacement was used. Nearest neighbor matching is defined as:

$$C(P_i) = \min_j ||P_i - P_j||$$

where P_i is the propensity scores for treated participants, while P_j represents the propensity scores for the control participants. A neighborhood, designated by $C(P_i)$, contains a control participant $_j$ and treatment participant $_i$, if the absolute difference between propensity scores is the smallest among all possible pairs of propensity scores between $_i$ and $_j$. After a matched sample is created, balance or the degree to which individuals in the treatment and control conditions resemble one another post-matching is evaluated by verifying that no statistically significant differences on observables exist between students in the treatment and newly formed control condition post-match. Table A2 presents the results from the balancing test. Prior to matching, statistically significant differences between students who earned an associate degree before transferring (treated) and those who did not (unadjusted control) were present across 12 of the 23 observable characteristics in the model. After matching, no statistically significant differences remained. Figure A1 presents a visual representation of the sample before and after matching. The after matching graph shows how the treated and control conditions more closely align after propensity score matching was applied.

5 See Becker and Ichino (2002) for a survey of the most frequently used balancing mechanisms.

Another use of the propensity score is as a weight to create a balanced sample. The main advantage of the weighting method is that these weights can be used in a similar form to survey sampling weights, and can thus be used in conjunction with other statistical approaches, including doubly robust estimation, used to adjust for covariates that could not be balanced through matching or to control for other important factors that are unrelated to the probability of receiving treatment. Doubly robust estimation was the principal approach used in this research brief.

The propensity score weights used in this study are defined as follows for control participants:

$$w(\chi) = K \frac{f(z = 1 \mid \chi)}{f(z = 0 \mid \chi)} = K \frac{b(\chi)}{1 - b(\chi)}$$

where $b(\chi)$ is the propensity (or assumed balancing) score described above and K is a normalization constant that will cancel out in the outcomes analysis (Ridgeway et al. 2016). Participants who received the treatment were assigned a weight of 1. Control cases that are the most unlike treatment cases are assigned a weight near 0, while control cases more similar to treatment cases were given a larger weight. With the weights calculated, a final propensity score weighted probit regression model was estimated. In this final model, the relationship between earning an associate degree prior to transfer and bachelor's degree attainment was estimated while controlling for the independent variables used to estimate the propensity score weights, as well as additional variables measuring the control, location, and selectivity of the students' first four-year institution, the total number of developmental courses taken at all institutions, and if the student had ever received a Pell Grant from any institution attended. The full results of this model are presented in Table 2 in the body of the brief.

Finally, it is common practice to present the results of the propensity score based models alongside multivariate models that do not take into consideration self-selection bias. Table A3 presents the summary of the results as estimated using 1) a simple bivariate or empty model, 2) a probit model, 3) a propensity score matched model, and 4) the doubly robust model or final model of the study. The bivariate model—that is, the impact of earning an associate degree prior to transfer on bachelor's degree attainment with no controls—shows a positive effect (9 percentage points). Taking into account additional control variables, but not addressing the self-selection bias, the naive probit model shows no statistically significant effect. Regardless of whether or not a student earned an associate

degree prior to transfer, his or her probability of attaining a bachelor's degree was approximately 57 percent. The results of both the propensity score matched and doubly robust (propensity score weighted) models further confirmed no statistically significant treatment effect. Table A4 presents the full results of both the naive probit and doubly robust models, presented as marginal effects. These full results highlight the differential impact of the independent variables before and after reducing baseline differences between students who earned an associate degree prior to transfer and those who did not. Finally, Table A5 presents the summary statistics of the variables used in the doubly robust or final model.

Table A1: Variable Definitions

	Definition	Used in generating propensity scores	Used in the doubly robust estimation
Bachelor's Degree Completion	1 = Student earned a bachelor's degree by 2014.	X	X
	0 = Student did not earn a bachelor's degree by 2014.		
Associate Degree Completion (Prior to Transfer)	1 = Student earned an associate degree at their first community college, before transferring to a four-year college or university.	X	X
	0 = Student did not earn an associate degree before transferring to a four-year college or university.		
Sex	1 = Female	X	X
	0 = Male		
African American	1 = African American	X	X
	0 = Not African American		
Asian/Pacific Islander	1 = Asian/Pacific Islander	X	X
	0 = Not Asian/Pacific Islander		
Hispanic	1 = Hispanic	X	X
	0 = Not Hispanic		
Other/Multiple Races	1 = Other/Multiple Races (Including American Indian)	X	X
	0 = Not Other/Multiple Races		
White*	1 = White	X	X
	0 = Not White		
Socioeconomic Status	A standardized composite measure of students' families' socioeconomic status. This composite metric is based on five equally weighted components: father's education, mother's education, family income, father's occupation, and mother's occupation.	X	X

Dual Enrollment	1 = Student took at least one college-level course offered by a postsecondary institution before leaving high school. 0 = Student enrolled in no college-level courses offered by a postsecondary institution before leaving high school.	X	X
AP Exam (3 or Better)	1 = Student earned a score of 3 or higher on any Advanced Placement exam. 0 = Student earned a score of 1 or 2 on any Advanced Placement exam or did not take any Advanced Placement exams.	X	X
Algebra II	1 = Student completed at least a half-year of alegbra II, trigonometry, pre-calculus, or calculus in high school. 0 = Student's highest level of math completed in high school was geometry, algebra I, pre-algebra, general or consumer math, or other math.	X	X
HS GPA	Cumulative grade point average earned for all courses in grades 9-12 on a four-point scale.	X	X
Entrance Exam	1 = Student reported having taken a college entrance exam (SAT or ACT) before leaving high school. 0 = Student reported having not taken a college entrance exam (SAT or ACT) before leaving high school.	X	X
Ed. Expectations (high school or less)*	1 = In their senior year, student reported expecting to complete no education above the high school level. 0 = All other expectations	X	X
Ed. Expectations (< 4 year degree)	1= In their senior year, student reported expecting their highest level of education to be some college or a two-year degree. 0 = All other expectations	X	X
Ed. Expectations (4 year degree)	1= In their senior year, student reported expecting their highest level of education to be a four-year degree. 0 = All other expectations	X	X
Ed. Expectations (graduate degree)	1= In their senior year, student reported expecting their highest level of education to be a graduate degree. 0 = All other expectations	X	X
Ed. Expectations (don't know)	1= In their senior year, student reported being unsure abouth their educational expectations. 0 = All other expectations	X	X
Delayed Enrollment	1 = Student enrolled in college more than three months after leaving high school. 0 = Student enrolled in college within three months of leaving high school.	X	X
Out of State Enrollment	1 = Student enrolled in a community college located in a different state than their high school. 0 = Student enrolled in a community college located in the same state than their high school.	X	X

Academic Advising	0 = At first postsecondary institution, student reported never meeting with an academic advisor. 1 = At first postsecondary institution, student reported sometimes meeting with an academic advisor. 2 = At first postsecondary institution, student reported frequently meeting with an academic advisor.	X	X
Extracurricular Activities	1 = Student reported participating in extracurricular activities at their first postsecondary institution. 0 = Student did not report participating in extracurricular activities at their first postsecondary institution.	X	X
Full-Time Enrollment	1 = Student maintained full-time enrollment status while at their first postsecondary institution. 0 = Student was enrolled part-time for at least one term while at their first postsecondary institution.	X	X
Developmental Math/English in First Year	1 = Student enrolled in developmental math or English courses in their first year of postsecondary enrollment. 0 = Student did not enroll in developmental math or English in their first year of postsecondary enrollment.	X	X
College GPA	Cumulative grade point average earned for all courses taken at first postsecondary institution.	X	X
Credits in First Year	Cumulative number of college-level credits earned during the first year of postsecondary enrollment after high school.	X	X
Total Developmental Education	The total number of postsecondary developmental education courses enrolled in by the student.		X
Received a Pell Grant	1 = Student receieved a Pell Grant at any time. 0 = Student did not receive a Pell Grant at any time.		X
Selectivity of First Four-Year Institution	0 = Not classified 1 = Inclusive 2 = Moderately selective 3 = Highly selective		X
Control of First Four-Year Institution (Public)*	1 = Institution was a public four-year college or university 0 = Institution was not a public four-year college or university		X
Control of First Four-Year Institution (Private)	1 = Institution was a private four-year college or university 0 = Institution was not a private four-year college or university		X
Control of First Four-Year Institution (For-Profit)	1 = Institution was a for-profit four-year college or university 0 = Institution was not a for-profit four-year college or university		X

Transferred Out of State	1 = Student transferred to a four-year institution located in a different state than their first postsecondary institution.		X
	0 = Student transferred to a four-year institution located in the same state as their first postsecondary institution.		

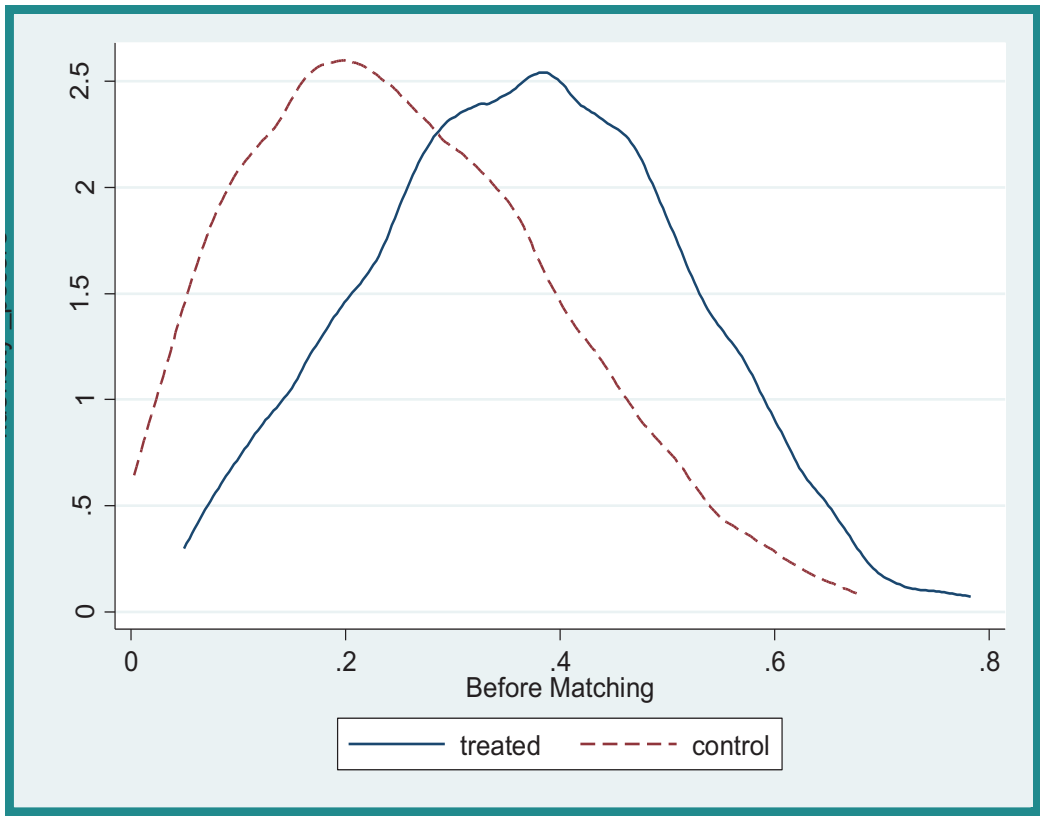
Notes:
* Denotes the reference category

Table A2: Results from Covariate Balancing

	Treated	Unadjusted Control	Adjusted Control
Female	0.583	0.556	0.583
African American	0.092	0.101	0.088
Asian/Pacific Islander	0.118	0.156+	0.122
Hispanic	0.152	0.109*	0.144
Other/Multiple Races	0.046	0.049	0.053
Socioeconomic Status	0.024	0.173***	0.037
Dual Enrollment	0.204	0.329***	0.207
AP Exam (3 or Better)	0.057	0.100*	0.059
Algebra II	0.862	0.871	0.871
HS GPA	2.964	2.914	2.952
Entrance Exam	0.753	0.767	0.763
Ed. Expectations (< 4 year degree)	0.112	0.107	0.116
Ed. Expectations (4 year degree)	0.480	0.385**	0.497
Ed. Expectations (graduate degree)	0.333	0.442**	0.318
Ed. Expectations (don't know)	0.060	0.058	0.055
Delayed Enrollment	0.086	0.106	0.084
Out of State Enrollment	0.057	0.051	0.055
Academic Advising	1.152	0.997***	1.145
Extracurricular Activities	0.474	0.433	0.453
Full-Time Enrollment (At First Institution)	0.897	0.816**	0.899
Developmental English/Math in First Year	0.520	0.437**	0.529
College GPA (At First Institution)	3.036	2.731***	3.038
Credits in First Year	20.546	15.390***	20.504
N =	350	860	860

Notes:
+p < .10 *p < .05 **p < .01 ***p < .001
Per Institute of Education Sciences guidelines, unweighted sample sizes were rounded to the nearest 10.

Figure A1: A Visual Representation of the Sample before and after Matching



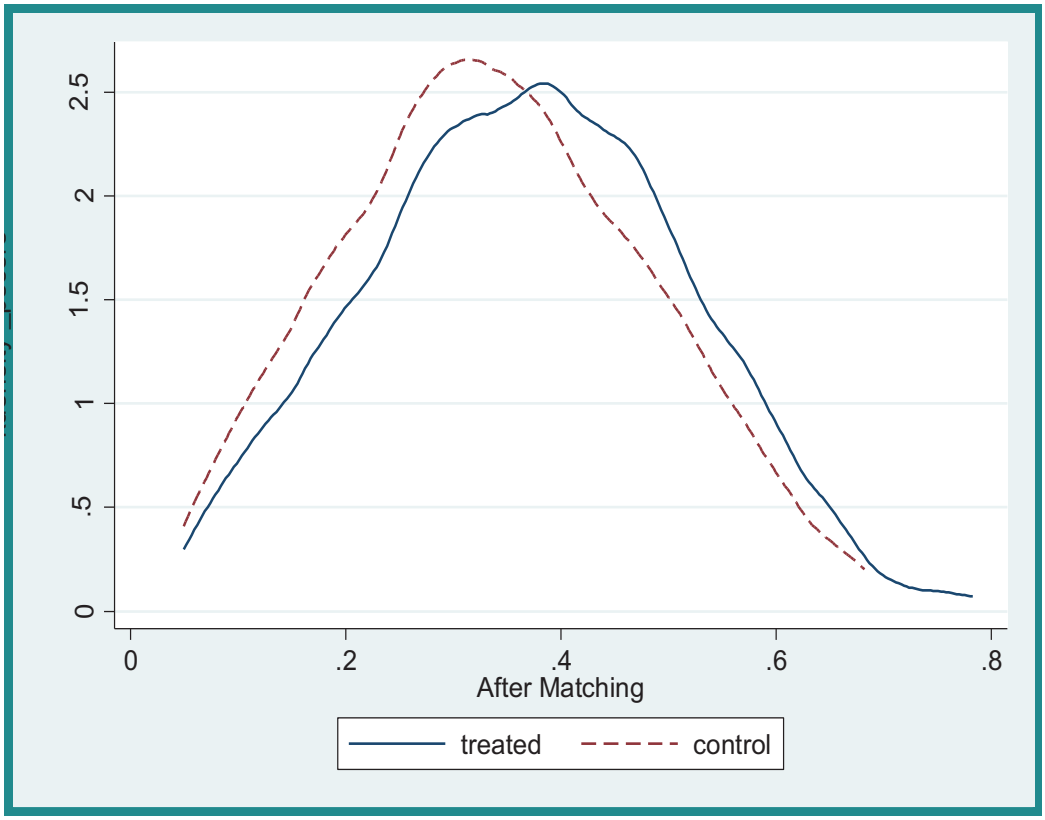


Table A3: Key Results from the Naive and Propensity Based Models

	1	2	3	4
	Bivariate	**Probit**	**PSM**	**Doubly Robust (ATT)**
Earned an Associate Degree Prior to Transfer				
Marginal Effect	0.090**	0.001	0.009	-0.000
	(0.031)	(0.092)	(0.044)	(0.035)
Predicted Probability for Treatment Group	0.629	0.568	0.629	0.642
Predicted Probability for Control Group	0.540	0.567	0.621	0.642
N =	1,200	1,200	700	1,200

Notes:

+p < .10 *p < .05 **p < .01 ***p < .001
Robust standard errors in parentheses. Per Institute of Education Sciences guidelines, unweighted sample sizes were rounded to the nearest 10.

Table A4: Side-by-Side Comparison of the Full Results of the Naive Probit and Doubly Robust Probit Regression Models

	Probit	Doubly Robust Probit
	Marginal Probability Effect	Marginal Probability Effect
Associate Degree	0.001	-0.000
	(0.036)	(0.035)
Female	0.057+	0.032
	(0.033)	(0.037)
African American	0.091	0.097
	0.057	(0.062)
Asian/Pacific Islander	0.087+	0.036
	(0.049)	(0.057)
Hispanic	-0.035	-0.058
	(0.052)	(0.056)
Other/Multiple Races	0.054	0.014
	(0.075)	(0.084)
Socioeconomic Status	0.008	-0.009
	(0.026)	(0.030)
Dual Enrollment	-0.009	-0.075
	(0.048)	0.058
AP Exam (3 or Better)	0.011	0.034
	0.063	(0.077)
Algebra II	0.026	0.006
	(0.052)	0.056
HS GPA	0.072*	0.069+
	(0.035)	(0.039)
Entrance Exam	0.083*	0.084+
	(0.041)	(0.044)
Ed. Expectations (< 4 year degree)	-0.214	-0.248
	(0.152)	(0.166)
Ed. Expectations (4 year degree)	-0.132	-0.175
	(0.151)	(0.151)
Ed. Expectations (graduate degree)	-0.204	-0.257
	(0.150)	(0.157)
Ed. Expectations (don't know)	-0.234	-0.320+
	(0.154)	(0.163)
Delayed Enrollment	-0.118*	-0.079
	(0.058)	(0.064)
Out of State Enrollment	-0.042	-0.008
	(0.074)	(0.083)

Developmental English/Math in First Year	0.009	0.010
	(0.042)	(0.046)
Academic Advising	0.013	0.012
	(0.025)	(0.028)
Extracurricular Activities	-0.038	-0.044
	(0.035)	(0.039)
Enrolled Exclusively Full-Time at First Institution	0.059	0.08
	(0.045)	(0.057)
GPA at First Institution	0.240***	0.246***
	(0.029)	(0.035)
Credits in First Year	0.003	-0.000
	(0.002)	(0.002)
Total Number of Developmental Courses Taken	-0.006	-0.007
	(0.009)	(0.009)
Ever Received a Pell Grant	-0.079*	-0.111**
	(0.035)	(0.039)
Selectivity of First Four-Year Institution	0.086***	0.073**
	(0.022)	(0.024)
Control of First Four-Year Institution: Private	0.037	0.068
	(0.042)	(0.045)
Control of First Four-Year Institution: For-Profit	-0.087	-0.203*
	(0.079)	(0.091)
First Four-Year Institution Different State	-0.024	-0.064
	(0.050)	(0.055)
Pseudo R^2	0.218	0.160
N =	1,200	1,200

Notes:
+p < .10 *p < .05 **p < .01 ***p < .001
Robust standard errors in parentheses. Per Institute of Education Sciences guidelines, unweighted sample sizes were rounded to the nearest 10.

Table A5: Descriptive Statistics for Variables Used in the Doubly Robust Probit Regression Model

	Mean (SD)
Bachelor's Degree	0.567
	(0.496)
Associate Degree	0.289
	(0.454)
Female	0.564
	(0.496)
African American	0.099
	(0.299)
Asian/Pacific Islander	0.143
	(0.350)
Hispanic	0.122
	(0.328)
Other/Multiple Races	0.048
	(0.214)
Socioeconomic Status	0.130
	(0.686)
Dual Enrollment	0.293
	(0.456)
AP Exam (3 or Better)	0.089
	(0.284)
Algebra II	0.868
	(0.339)
HS GPA	2.928
	(0.625)
Entrance Exam	0.762
	(0.426)
Ed. Expectations (< 4 year degree)	0.108
	(0.311)
Ed. Expectations (4 year degree)	0.412
	(0.492)
Ed. Expectations (graduate degree)	0.411
	(0.492)
Ed. Expectations (don't know)	0.059
	(0.236)
Delayed Enrollment	0.100
	(0.300)

Out of State Enrollment	0.052
	(0.221)
Developmental English/Math in First Year	0.461
	(0.499)
Academic Advising	1.042
	(0.656)
Extracurricular Activities	0.445
	(0.497)
Enrolled Exclusively Full-Time at First Institution	0.840
	(0.366)
GPA at First Institution	2.819
	(0.829)
Credits in First Year	16.890
	(11.335)
Total Number of Developmental Courses Taken	1.645
	(2.387)
Ever Received a Pell Grant	0.552
	(0.498)
Selectivity of First Four-Year Institution	2.741
	(0.911)
Control of First Four-Year Institution: Private	0.200
	(0.400)
Control of First Four-Year Institution: For-Profit	0.088
	(0.284)
First Four-Year Institution Different State	0.170
	(0.376)
N =	1,200

Notes:
Per Institute of Education Sciences guidelines, unweighted sample sizes were rounded to the nearest 10.

ACE American Council on Education
CPRS Center for Policy Research and Strategy

HOBSONS