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Should Community College Students Earn an Associate Degree Before Transferring to a Four-Year Institution?

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Abstract

Community colleges are the postsecondary entry point for thousands of students each year in the United States. Over 80 percent of these students indicate a desire to earn a bachelor's degree or higher (Horn & Skomsvold, 2011). However, according to studies by the National Student Clearinghouse, only about 15 percent of all students who start at two-year public colleges earn a bachelor's degree within six years (Shapiro et al., 2012). Although the expected pathway for community college students seeking a bachelor's degree includes earning an associate degree, little is known about the impact of earning an associate degree on bachelor's degree completion. This paper thus seeks to answer the following question: Are community college students who earn an associate degree before transferring to a four-year college more likely to earn a bachelor's degree?

Using data on students in one state who entered community college and then transferred, we find large, positive apparent impacts of earning the transfer-oriented (e.g., Associate in Arts) associate degree on the probability of earning a bachelor's degree within four, five, and six years. However, we do not find any apparent impact associated with earning one of the workforce-oriented (e.g., Associate in Applied Science) degrees that are awarded by programs typically designed for direct labor market entry. This is an important distinction, as all associate degrees are not equal in their potential impacts on future baccalaureate completion.

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1. Introduction

Community colleges are the postsecondary entry point for thousands of students each year in the United States. Over 80 percent of these students indicate a desire to earn a bachelor's degree or higher (Horn & Skomsvold, 2011). However, according to studies by the National Student Clearinghouse (NSC), only about 15 percent of all students who start at two-year colleges earn a bachelor's degree within six years (Shapiro et al., 2012). Although the expected pathway for community college students seeking a bachelor's degree includes earning an associate degree, little is known about the value of the associate degree or its impact on bachelor's degree completion. This paper thus seeks to answer the following question: Are community college students who earn an associate degree before transferring to a four-year college more likely to earn a bachelor's degree?

Bachelor's degree attainment rates for students who transferred with a community college credential were found to be up to 16 percentage points higher than those for students who transferred without a credential (Shapiro et al., 2013). Recent research that uses detailed wage and transcript data on students who began at community college also highlights important links between associate and bachelor's degree completion, particularly from a financial perspective. Belfield (2013) computed the net benefits to students who transferred with and without the associate degree and who then did and did not earn a bachelor's degree. He found that the net benefits of choosing to complete an associate degree before transfer are greater than the net benefits of early transfer, due in part to uncertainty about whether the student will complete a bachelor's degree after transferring. In addition, more accumulated credits may indicate that a student is further along in his or her program of study, which could make it easier for that student to earn a bachelor's degree. At the same time, more credits can delay bachelor's degree completion if those credits do not properly transfer to the receiving institution. In theory, earning an associate degree before transfer should propel a student toward successful baccalaureate completion (any Bachelor of Arts or Bachelor of Science), unless a longer period of study at the community college acts to slow the student down or puts the student on a less efficient pathway.

Although there has been growing interest in determining whether the pre-transfer credential is important or not (Crook, Chellman, & Holod, 2012), there is a paucity of evidence on the particular effects of earning an associate degree before transfer. Students can transfer from community colleges to four-year institutions either before or after they earn an associate degree or other credential.¹ However, there is no convincing evidence that encouraging students to earn the degree before transferring is a good (or bad) policy to pursue. It could be that students are better off if they transfer as soon as they possibly can, as this will reduce their likelihood of earning non-transferrable community college credits and will integrate them sooner into the culture, environment, and program pathway of the four-year college. On the other hand, taking as many college credits as possible before transfer could be desirable because it is potentially cheaper and students can more easily afford to finish. In general, it is not immediately clear what the optimal strategy is for students who start at community colleges and desire a baccalaureate.²

Whether a student transfers with or without an associate degree may also impact the quality of that transfer student's destination college, which could then also influence outcomes. There is some evidence that college quality does indeed impact student outcomes. Cohodes and Goodman (2013), for example, found causal evidence suggesting that enrollment in colleges of lesser quality significantly impacts graduation rates among students. Furthermore, recent work by Liu and Belfield (2014) shows that transfer into low-quality, for-profit schools among community college students is correlated with poorer post-college outcomes as compared with their non-profit transferring peers.

Due to the causal nature surrounding this paper's central research question, we encounter a range of analytical challenges. Comparing four-year outcomes (such as earning a baccalaureate) between a group of students who transferred before earning an associate degree and a group who transferred after earning an associate degree is problematic due to selection: the students in each of these groups chose to either transfer early or not and to earn an associate degree or not. Several factors may have influenced how students ultimately decided on which path to take, and there are likely some characteristics of students that are correlated with both the decision to earn the associate

¹ Students also regularly "swirl" between these sectors, an issue not addressed in this paper.

² Furthermore, optimal strategies may differ from state to state and even college to college depending on the policy regime.

degree and outcomes after transfer. Thus we do not know whether any difference in outcomes is largely due to earning the two-year credential or whether such differences are attributable to other confounding factors or unobserved characteristics.

To address this selection problem, this paper employs multiple strategies. We restrict the analysis sample to students who had between 50 and 90 community college credits *before* they transferred. There are students in this credit range who did and did not earn an associate degree. What is important is that the students arrived at the four-year institution with a similar number of earned and potentially transferable college credits. Moreover, the fact that these students earned a substantial number of credits at a community college before transferring may set them apart in terms of motivation from students who transferred after amassing only a small number of credits. We also implement propensity score matching and control for the time of transfer in the analysis to adjust our comparisons for selection biases.

To preview our results, we find large, positive correlations between earning the transfer-oriented (e.g., Associate in Arts [AA] or Associate in Science [AS]) associate degree and the probability of earning a bachelor's degree within four, five, and six years. However, we do not find any apparent impact associated with earning one of the workforce-oriented (e.g., Associate in Applied Science [AAS]) degrees that are awarded by programs typically designed for direct labor market entry. This is an important distinction, as all associate degrees are not equal in their potential impacts on future baccalaureate completion.

The organization of this paper is as follows: section 2 reviews the literature on associate degrees, transfer, and bachelor's degree attainment; section 3 discusses our empirical strategy; section 4 introduces the data and descriptive statistics; section 5 reports results; section 6 reports sensitivity tests; and section 7 discusses policy implications and concludes the paper.

2. Literature Review

2.1 Background

While there are arguments suggesting that associate degree completion may negatively impact transfer students (e.g., by increasing time to transfer or increasing time to bachelor's degree completion), there are several reasons why we might expect an associate degree to improve various outcomes among community college transfer students reasons (e.g., signaling, credit transferability, increased structure). In a classical signaling model, for example, having a degree may convey important information about the student to the four-year institution (see Spence, 1973). That is, the degree signals to the college that the student possesses a certain quality or ability, which could result in improved financial aid awards or an increased number of credits accepted at the transfer institution, thereby positively impacting that student's success. It has been well documented that community college credentials are associated with a "sheepskin" effect on wages, increasing the labor market returns to education compared with individuals who have the same amount of schooling (in years) but who do not have a degree (Jaeger & Page, 1996; Belfield & Bailey, 2011). One could assume a similar phenomenon to occur in the academic world, where institutions use associate degree completion to determine eligibility for college acceptance or for financial aid awards. From a different perspective, however, earning an associate degree could signal lower perceived ability or less motivation for a bachelor's degree, especially if the associate degree is valuable (enabling the student to enter the labor force sooner at a higher wage, thereby reducing the bachelor's degree incentive) (Ehrenberg & Smith, 2004).

Unfortunately, very little research has been conducted on the signaling value of an associate degree to the four-year institution. What descriptive information is available on the relationship between rates of degree completion at the community college and differences in levels of postsecondary preparedness suggests, however, that transfer students who have bachelor's degree intentions do not, for the most part, earn an associate degree before transferring (Hoachlander, Sikora, & Horn, 2003). In fact, a report conducted by the NSC found that only 64 percent of students transferring from two-year to four-year institutions actually earned an associate degree before transferring

(Shapiro et al., 2013). This finding could indicate that the associate degree is not perceived as a valuable signal of better baccalaureate outcomes.

On the other hand, the recent proliferation of articulation policies between two-year and four-year institutions, which can guarantee junior status for associate degree–holding community college transfer students from the same state (Smith, 2010), suggests that associate degree completion can be a useful tool for community college students hoping to earn a baccalaureate, as this may allow for greater transferability of credits. Indeed, the limited research available on the impact of credit accumulation and associate degree attainment on transferability has shown that students who earn an associate degree are nearly 40 times more likely to transfer (Roksa & Calcagno, 2010). Furthermore, and more relevant to the present study, research has also shown that higher credit accumulation increases the likelihood of baccalaureate completion among community college transfer students (Koker & Hendel, 2003). Doyle (2006), for instance, found that 82 percent of students who were able to utilize all of their pre-transfer credits graduated within six years of transfer, as compared with only 42 percent of their peers who were unable to use all of their pre-transfer credits at their four-year institution. These studies lend some support to the theory that earning an associate degree before transferring improves degree progress post-transfer.

Finally, it could also be argued that a deliberately structured pathway toward an associate degree benefits students at the outset of their community college career. These students could be at an advantage over their non-associate-degree seeking peers who arguably wandered through a more chaotic set of courses, inasmuch as improved course cohesion may leave the student in a more favorable or advanced position in the bachelor’s degree progression process post-transfer. The *structure hypothesis* argues that community college students who are offered efficient pathways are less wasteful—they are less likely to retake college courses, less likely to deviate, even if unintentionally, away from their original academic plans and goals, and potentially less likely to be deterred by bureaucratic barriers (Scott-Clayton, 2011). Unfortunately, this hypothesis has not yet garnered much attention from researchers, despite recent research suggesting that community college students are often confused and concerned about the transfer process (Jaggars & Fletcher, 2014; Kadlec & Martinez, 2013).

2.2 Previous Work

Though much has been written about transfer in community colleges (see Belfield & Bailey, 2011), very few studies have specifically addressed the impact of earning an associate degree prior to transfer on degree progress post-transfer. Instead, one line of inquiry has looked at success among students who have already transferred (Wang, 2009; Townsend & Wilson 2006; Carlan & Byxbe, 2000; Glass, Jr. & Harrington, 2010; Melguizo, Kienzl, & Alfonso, 2011), without parsing out any of the differential impacts of associate degree completion prior to transfer. Another segment of the research literature has focused on the impact of associate degree completion on student transferability in the context of agreements between two- and four-year institutions called *articulation agreements* (Roksa & Keith, 2008; Gross & Goldhaber, 2009; Anderson, Alfonso, & Sun, 2006). However, these studies are mostly focused on the impacts of the articulation agreement itself, as opposed to the specific relationship between associate degree completion and bachelor's degree outcomes.

Although minimal research has been completed to address the various reasons why we might expect an associate degree to improve bachelor's degree completion after transfer, two studies that focus on college systems in New York State are particularly relevant to this present work. Ehrenberg and Smith (2004) used grouped data from the State University of New York (SUNY) to study transfer and found that students with an AA/AS transfer-oriented degree had a greater probability (20 percentage points) of earning a four-year degree within three years than students without the degree. They found a smaller association (15 percentage points) for students who earned the vocationally oriented AAS degree before transferring. Although the number of credits earned in the community college by students was not specifically controlled for, the authors did omit part-time students from the analysis to avoid any potential bias that would be introduced if the proportion of transfer students who were part-time systematically varied across the four-year institutions considered. In addition, county average unemployment rates and average annual earnings during the three years after transfer, as well as a dichotomous variable for the year of transfer, were included to account for any influence that labor market conditions might have had on student persistence among transfer students. Crook et al. (2012) studied the impact of community

college credits and associate degree attainment on transfer students' probability of earning a bachelor's degree within four years of transfer using data from the City University of New York (CUNY). Using a regression analysis, the authors separately addressed the AA and AS two-year degrees and included both a standardized measure (z-score) of the number of credits accumulated prior to transfer and the number of credits squared to capture any nonlinear relationship between credits earned and graduation. They found that students who earned an AA or AS were 6.9 percentage points more likely to earn a bachelor's degree. No effect was found for students who earned an AAS. The authors attributed this finding in part to CUNY's system-wide articulation policy that rewards students who earn an AA or AS degree with 60 credits toward the baccalaureate and satisfaction of the general education requirement.

2.3 Limitations in the Literature

Students with different ability and motivation levels, goal clarity, and financial constraints will demonstrate patterns of credit accumulation and degree completion that vary considerably; this issue has not yet been sufficiently addressed in the research literature. It is nevertheless important to recognize that these factors may impact a student's decision to earn an associate degree before transfer. For example, students with clear baccalaureate goals may place little value on the associate degree, which could explain why students who entered into college-level programs early in their community college career were more likely to transfer before earning a credential than their peers (Jenkins & Cho, 2013). Financial considerations might also impact student decisions. Attending a community college before four-year institutional enrollment can often be monetarily beneficial, as tuition is generally cheaper at community colleges, and students may be able to live at home to avoid room and board expenses. This could lead students to consider associate degree completion to be a wise investment (Liu & Belfield, 2014). However, students may not be aware of these relationships. In fact, some studies have found that students do not really understand the financial implications of college choice, often to the detriment of their academic outcomes (e.g., Cohodes & Goodman, 2013).

Although some research on the relationship between associate degree and bachelor's degree completion has partially attempted to overcome the aforementioned

methodological issues through subgroup analysis (Shapiro et al., 2013) or through the introduction of proxies for certain unobservable characteristics (Roska & Calcagno, 2010), it is impossible to account or control for all student characteristics that may influence student decisions. Further, it is not always clear exactly how such unobservable characteristics manifest themselves, lending uncertainty to the reliability of any given proxy. To omit such variables, however, can induce biases. A failure to adequately account for selection leads to unreliable results, a problem rife in much of education research (Melguizo et al., 2011).

2.4 The Current Study

The present research builds upon studies such as Crook et al. (2012) by also studying student transfer under a single state policy regime (although in a different state). However, the analysis deviates in two important ways from the aforementioned study. First, as explained below, our outcome variables are measured relative to the time at which students began community college rather than to the time at which they first transferred. Using the time of first college entrance as the time origin means that our outcomes provide a more realistic view of time to college completion and do not ignore the potentially numerous semesters a student may spend at the community college. In addition, we restrict the sample based on credits earned and employ propensity score matching in an attempt to retrieve estimates that are closer to the true causal effect. Details of this are provided below.

3. Empirical Strategy

Estimating the effect of earning an associate degree at the community college before transferring to a four-year institution is challenging. Consider a standard model:

$$Y_i = \alpha + \beta X_i + \gamma Assoc_i + \varepsilon_i, \quad (1)$$

where Y_i is the outcome for student i (earned a bachelor's degree within four years), X_i is a vector of student background characteristics, $Assoc_i$ is an indicator equal to 1 if student i earned an associate degree before transferring, and ε_i is the error term. We include institutional-level fixed effects in the models as well to account for impacts that are

specific to individual institutions over time. Since students are not randomly assigned to earn or not earn community college degrees before transferring, simple comparisons of outcomes (estimates of γ) between students who transfer with and without credentials will not simply reflect the difference in outcomes due to earning the associate degree or not before transferring. Rather, the difference will be biased by characteristics of students in each group that are correlated with both the decision to earn the credential and outcomes at four-year institutions.

The potential factors that drive the decision to transfer pre- or post-associate degree may not only come from student characteristics but also from the wider policy context. Students at community colleges in the state under study here were operating under a statewide articulation agreement that governed the transfer of credits between all community colleges, both public four-year institutions, and a group of in-state private universities. The agreement provides clear incentives for transferring with an AA or AS degree: after earning an AA or AS, a student may transfer with junior status, the lower-division general education core will be satisfied, and the student can transfer up to 64 credits (provided that certain GPA and grade minimums are met).³ In contrast, students who earn the AAS degree—designed to be a terminal credential, not a transfer degree—do not have such guarantees. Although students do receive credit for approved college transfer courses, articulation of AAS programs is handled on a bilateral basis between institutions. Students who do not earn an AA or AS and transfer receive credit on a course-by-course basis; it is up to the destination college to determine whether the course is to be counted toward the student's general education credits, toward her major, or as an elective credit. Students with bachelor's degree ambitions who are aware of the articulation policy may consider this when making decisions about transfer.

The selection problem (or omitted variables problem) is further compounded by the fact that students who transfer do so at various times and with varying amounts of earned credits. A comparison of the outcomes of transfer students with and without community college credentials includes students who transferred with almost 60 credits as well as those who transferred with very few credits—students with quite different

³ There is not a guarantee, however, that transfer credits will count as anything other than general electives, and so students may have to repeat courses at the four-year college in order to satisfy requirements for specific majors.

starting positions at the four-year institution. A simple comparison is therefore problematic, as one group may have an advantage over the other group.

A last challenge addressed in this analysis is created by censored observations. After starting at community college, students choose to continue their postsecondary education at various points in time (see Crosta, 2013). Some transfer within the first year of study, while others wait much longer before transferring. For example, some students earn 12 credits and transfer in term 2, others earn 12 credits and transfer in term 18, others earn an AA in term 7 and transfer immediately, and still others earn that same AA in term 7 or 19 and transfer in term 20. Later transfer students are much less likely to be observed with four-year outcomes such as earning a bachelor's degree than those who transfer early. Systematic and unaccountable differences between students who transfer earlier and later could bias our comparisons.

We take several measures to address these analytical challenges. First, we restrict the sample to students who earned a certain number of credits. This strategy acknowledges that simply comparing students who have and have not earned the credential before transferring includes students who will have transferred with three community college credits and others who will have transferred with 60. Importantly, we remove students who may never have intended to earn a community college degree (those with very few credits who transfer). Since the average AA/AS degree is 64 credits, the average AAS degree is about 70 credits, and students may earn more community college credits than necessary, our main analysis restricts the sample to students who earned between 50 and 90 college-level credits at the time of transfer. Therefore, we compare students who have *around* 60 community college credits with those who have *around* 60 community college credits and an associate degree. We estimate separate models for students in transfer-oriented (AA/AS) programs and for students in workforce- or vocationally-oriented (AAS) programs to avoid biases associated with program selection and because the programs have different goals (even though they both result in an associate degree). Since we do not know the mechanisms of selection for transferring early versus late, we focus only on those who transferred late and could, in theory, have earned an associate degree. This credit window surrounds the credits

required for a degree, and thus students in the sample have made somewhat similar progress toward the baccalaureate before transferring.

The second empirical technique employed in this paper is propensity score matching (PSM) (Shadish, Cook, & Campbell, 2002). PSM relies on observable characteristics to determine the predicted probability that a transfer student receives an associate degree before transferring; this predicted probability is then interpreted as a score or weight that is used to match degree holders to non-degree holders. In other words, the propensity score is calculated as the probability of taking treatment T —in this case, earning an associate degree before transferring—given a vector of observed variables X :

$$p(x) = Pr[T=1/X=x]. \quad (2)$$

The following student characteristics are employed in the prediction equations: sex, age, race, limited English proficiency status, whether the student received a high school diploma, U.S. citizenship status, employment status in the first term, and proxies for ability. Matching students is achieved by using nearest neighbors with the goals of providing a comparison group (students who transfer without an associate degree) that is observationally similar to the treatment group (students who transfer with an associate degree) and estimating an average treatment effect on the treated (ATT).

To address the third challenge of potentially censored outcomes, we introduce a control for time of transfer by including a variable in our model that represents the term number (1, 2, 3...) of first transfer and estimating it as a separate parameter. Comparisons must account for students transferring at different times in our observable window. This control should offset any bias introduced by transfer timing that is systematically different between groups.

4. Data

The data for this study come from a community college system in a single state. We track about 40,000 first-time-in-college (FTIC) students who began at one of the state's community colleges between fall 2002 and summer 2005 and who transferred to a four-year institution within six years of entering community college. We consider that a

student has transferred if she has any enrollment in a four-year institution, public or private, after enrollment in community college (we exclude students who were enrolled at a four-year prior to or during their first community college semester). We have a rich set of demographic information including sex, age, race, limited English proficiency status, high school diploma, citizenship, employment status in the first term, and proxies for ability as determined by enrollment in developmental education courses.

The outcomes of interest are whether or not the student earned a baccalaureate (any bachelor of arts or bachelor of science degree) within four, five, and six years of starting community college.⁴ We consider different time frames to see how results are sensitive to the measurement interval chosen. Bachelor's degree data are retrieved from the NSC based on a match that the state system performed using unique student identifiers.

4.1 Limitations

Though we are careful to be explicit regarding the assumptions and restrictions of our model, there are some limitations worth discussing. First, although we ultimately desire an estimate of causal parameters, we are still using quasi-experimental methods and thus cannot interpret our results as causal. Second, the sample restriction that limits the analysis to those who have a substantial number of earned community college credits means that findings may not be generalizable across a wide range of transfer students. That is, many community college students exit their first institution and transfer to a four-year institution before earning 50 credits. This study does not analyze these earlier transfer students, and thus the interpretation of our results is limited to students who earn a relatively large number of community college credits.⁵ Third, while we are attempting to approximate the relationship between the associate degree and future bachelor's degree attainment, we lack measures of student intent with regard to bachelor's degree

⁴ Six years is considered to be the standard length of time for baccalaureate completion, as it is 150 percent of the expected time to degree for first-time, full-time students. We also look at four- and five-year completion rates to determine whether results are robust to these alternative time frames.

⁵ It should be noted, however, that in some ways this seeming "limitation" can actually be considered an improvement upon earlier work that simply controls for credits earned (i.e., Crook et al., 2012). Controlling for credits alone constrains the effect of the associate degree to be the same for all levels of credits earned, which is difficult to justify. Restricting the sample as we do, however, allows us to appropriately generalize the impact of associate degree completion to a more similar group of students.

completion. The fact that students must have transferred to a four-year institution to be included in our sample, however, provides at least some evidence of a student's desire for a bachelor's degree. Additionally, any remaining lack of intent will likely induce attenuation, suggesting that any apparent impacts uncovered may actually be greater than those presented here. Fourth, although it is advantageous in many ways to study students who are under a common state policy regime, one drawback is that this paper's findings may only be applicable to students in states that have similar articulation policies and degree programs to the one under study. Finally, a potential limitation is reliance on NSC data to capture transfer and baccalaureate attainment data. Since not all colleges participate in the service, we are unable to identify all transfer students and degree holders. However, most students in our state do transfer to institutions that report to the NSC.⁶

4.2 Descriptive Statistics

The two groups that provide the variation for this study are transfer students who did and did not earn associate degree credentials. Though we do not have detailed enough information to understand exactly how these students made their decisions, we can begin to better understand them by looking at their background characteristics. Table 1 presents comparisons of transfer students who did and did not earn associate degrees. The two first columns contain all students who transferred to a four-year institution. The next six columns focus on students who earned 50 to 90 community college (non-developmental) credits, those in our analysis sample. We present statistics for all 13,744 of these students and then break them down by declared program of study in the first term—either a transfer-oriented program (AA/AS) or a workforce-oriented associate in applied science (AAS) program that is not specifically designed for college transfer.⁷ Descriptive statistics for each group together are presented in Appendix Table A.1.⁸

⁶ Less than one third of the entire sample of transfer students attended a school that did not report degree completion to the NSC.

⁷ Students select a program of study, AA/AS or AAS, upon applying to the college. Though AAS programs are not designed for college transfer, several two- and four-year institutions have developed bilateral agreements to facilitate transfer for AAS degree recipients. These special agreements, however, are neither supported nor enforced by the state.

⁸ Comparing the first two columns of Table A.1 provides a way of understanding how our restricted credit analysis sample is different from that of all transfer students. Students in our credit-restricted group were

In the first two columns of Table 1, we note characteristics associated with the two groups of transfer students. First we find differences along race and sex dimensions, with female students and White students more highly represented among associate degree earners than among non-earners. Although associate degree earners were more likely to enroll with a high school diploma, they were also more likely to take math developmental education courses (and also more likely to take developmental courses in general). As expected, associate degree earners had a later time of transfer (measured in semesters enrolled) and they earned more community college credits at a higher grade point average than their non-earner peers.

When focusing on our analysis sample of students with 50–90 credits, some of the differences noted previously persist while other gaps are closed. The third and fourth columns of Table 1 show that earners of any associate degree were still more likely to be female than non-earners but that the differences in racial composition are no longer present. Non-earners were also less likely to have earned a high school diploma and more likely to have taken both subjects of developmental education. Associate degree earners accumulated about 6.3 more community college credits and had GPAs that were about two-tenths higher than non-earners.

The remaining four columns in Table 1 break our analysis sample into groups of students who were in transfer-oriented programs (AA/AS) or workforce-oriented programs (AAS). There are small differences between AA/AS earners and non-earners based on the information available, but larger differences exist between AA/AS and AAS students and within AAS students. AAS students were older and more racially diverse than their AA/AS counterparts. Within AAS students, those who earned the associate degree were three years older than those who did not. AAS earners, however, appear to have been more positively selected academically—they had higher high school diploma earning rates and lower rates of taking developmental education. This is the prototypical profile of the older, mature, focused, vocationally oriented community college student.

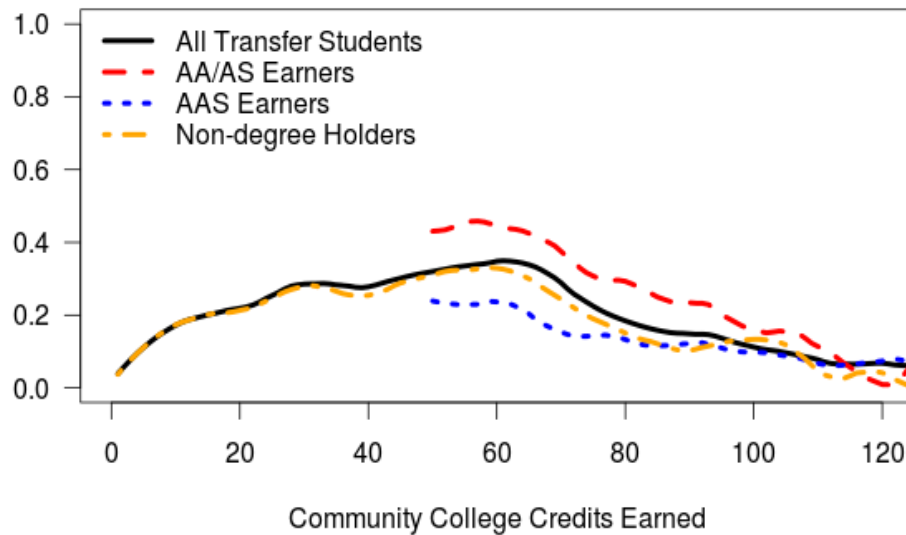
around the same age (perhaps slightly younger) but were more likely to be White, less likely to be Black, and more likely to have enrolled in developmental education than the larger sample of all transfer students. Surprisingly, students with 50–90 credits transferred after about the same number of terms as the sample of all students, about 17 terms or five years of study.

Table 1
Descriptive Characteristics by Degree Status

	Total Sample		50–90 Credits					
	Earned Any AA	Did Not Earn AA	All		AA/AS		AAS	
			Earned Any AA	Did Not Earn AA	Earned AA/AS	Did not Earn AA/AS	Earned AAS	Did Not Earn AAS
Student Demographics								
Female	65.4%	59.6%	64.1%	58.3%	58.4%	54.1%	69.1%	62.4%
Age	25.6	24.6	25.4	23.6	23.2	22.2	29.0	26.1
White	68.4%	55.9%	68.8%	67.4%	77.8%	74.7%	56.3%	58.8%
Black	21.6%	34.2%	21.3%	21.9%	11.9%	14.2%	35.7%	30.8%
Native American	1.6%	1.5%	1.6%	1.4%	1.1%	1.2%	1.9%	1.6%
Hispanic	3.3%	3.6%	3.2%	3.4%	3.4%	3.5%	2.5%	3.7%
Asian	2.6%	2.1%	2.6%	3.2%	3.1%	3.5%	1.4%	2.9%
Other	2.5%	2.7%	2.5%	2.7%	2.8%	2.8%	2.2%	2.1%
LEP	0.6%	0.4%	0.6%	0.6%	0.6%	0.6%	0.5%	1.0%
US Citizen	97.2%	97.5%	97.3%	95.8%	97.0%	96.0%	97.8%	96.6%
Labor Characteristics								
Employed in First Term	59.0%	59.0%	58.9%	58.3%	59.9%	60.4%	56.9%	56.4%
Academic Preparation								
HS Diploma	96.8%	94.0%	96.7%	92.2%	96.9%	91.7%	97.0%	94.9%
Took Developmental Math	49.9%	43.8%	51.9%	53.2%	52.8%	51.5%	47.6%	58.0%
Took Developmental English	24.7%	27.5%	25.8%	28.0%	22.0%	25.3%	29.2%	33.8%
Took Any Developmental	54.7%	49.6%	56.7%	58.9%	57.7%	57.4%	52.2%	63.3%
Enrollment Characteristics								
Time of First Transfer	18.0	16.8	17.9	17.5	16.4	16.5	19.3	19.4
CC Credits Earned	74.0	27.6	70.6	64.3	68.3	64.5	72.2	67.8
Average CC GPA	3.21	2.87	3.2	2.98	3.1	3.1	3.1	3.1
Total Students	10095	30880	7526	6218	3700	4268	2225	1838

A visual representation of the relationship between the probability of earning a bachelor’s degree within six years and the number of community college credits for each of the aforementioned groups is depicted in Figure 1. Generally speaking, there is a positive relationship (at least for the first 60 credits) between accumulating community college credits and the probability of obtaining a bachelor’s degree within six years. For all transfer students, the probability increases most quickly for the first 25 credits and slowly increases to 60 before inverting. From the figure, students who earned an AA or AS had a bachelor’s degree completion rate that was almost 20 percentage points higher than that for students without an associate degree. There is a clear distinction suggested between accumulated credits before transfer and earning an associate degree before transfer.

Figure 1
Relationship Between the Probability of Earning a Bachelor’s Degree Within Six Years
and the Number of Community College Credits Earned



A more in-depth summary of bachelor’s degree outcomes for students with 50–90 community college credits before transferring is provided in Table 2. The first row indicates that among all transfer students included in our sample, 4.5 percent received a bachelor’s degree within four years; after six years, however, over one-quarter earned a

degree. There is a small, two percentage point difference in rates between associate degree earners and non-earners. Rates were higher among students in transfer-oriented (AA/AS) programs (up to 35 percent within six years) and lower among students in AAS programs. Notably, the difference in bachelor’s degree rates between AA/AS earners and non-earners grows from 3.1 to 6.2 to 9.5 percentage points as we extend the time frame from within four to within six years after entering community college; the gap for all transfers and for AAS students remains roughly constant over time.

Table 2
Summary of Bachelor’s Degree Completion Rates by Program

	Earned a BA in 4 Years	Earned a BA in 5 Years	Earned a BA in 6 Years	N
Any Degree Program	4.5%	16.2%	27.8%	13,744
Associate	5.2%	17.0%	28.7%	7,526
No Associate	3.8%	15.3%	26.7%	6,218
AA/AS Program	5.6%	20.9%	35.4%	7,968
AA/AS	7.3%	24.2%	40.5%	3,700
No AA/AS	4.2%	18.0%	31.0%	4,268
AAS Program	3.4%	10.3%	17.7%	4,063
AAS	3.6%	10.9%	17.9%	2,225
No AAS	3.2%	9.7%	17.5%	1,838

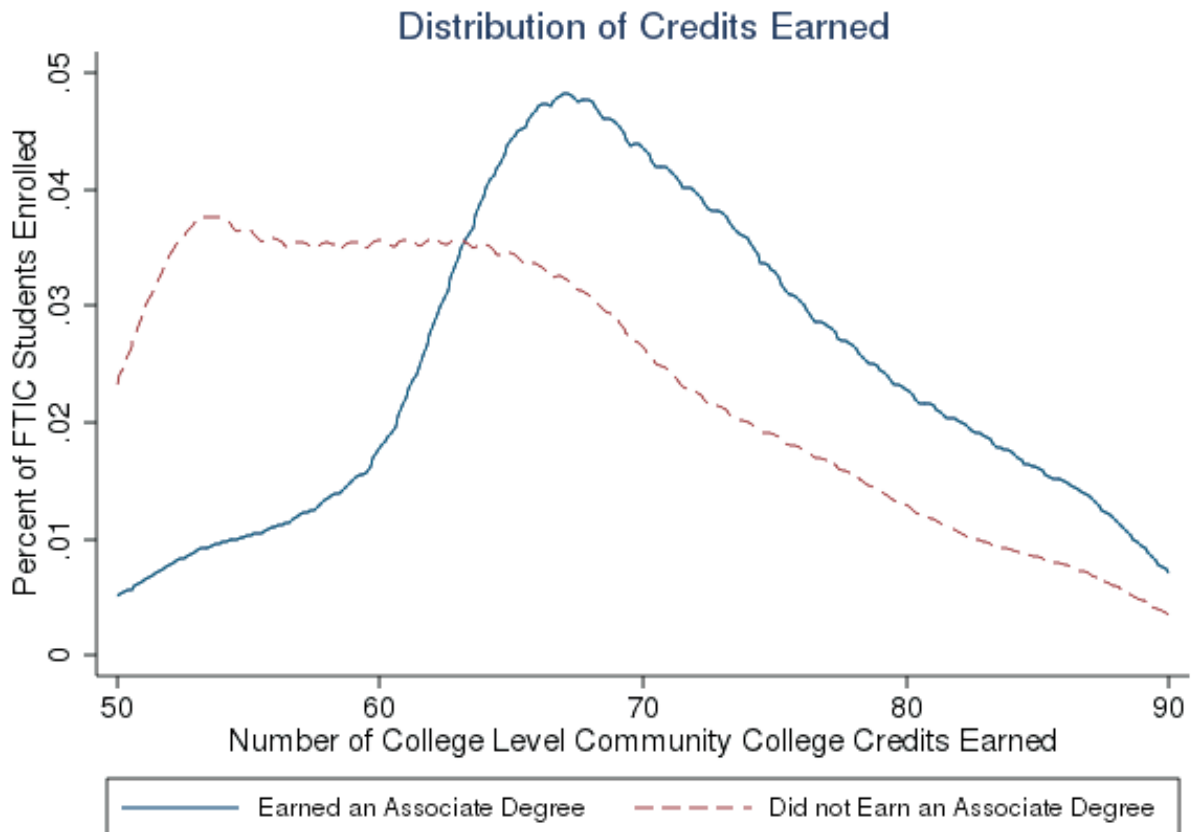
Note. Only transfer students who have earned 50–90 community college credits. BA means any baccalaureate credential (including bachelor of arts, bachelor of science, etc.).

While the completion rates presented in Table 2 are substantially lower than those reported by the NSC (Shapiro et al., 2013), it is important to know that the NSC looks at completion rates five years after students transfer and includes any student who begins at a community college. Also, while this study targets FTIC students, NSC’s sample includes students who had at least one enrollment at a two-year college within the four years prior to their first enrollment at a four-year institution, which could include students who were admitted to four-year colleges but who took a summer course at a community college prior to their first semester in college, as well as dual enrollment students. Still, it may come as a surprise that bachelor’s degree completion rates are rather low for students who have nearly half of the required credits for the degree.

4.3 Community College Credits and Associate Degree Status

Figure 2 shows the distribution of non-remedial community college credits earned by transfer students in two groups: those who earned any associate degree and those who earned no associate degree (graphs by particular associate degree type look similar). The credit distributions are as expected, with most of the mass for associate degree holders further to the right (more credits) than the mass of those without degrees. In general, the distributions do overlap substantially, which enables us to compare these restricted credit groups in our regression models.

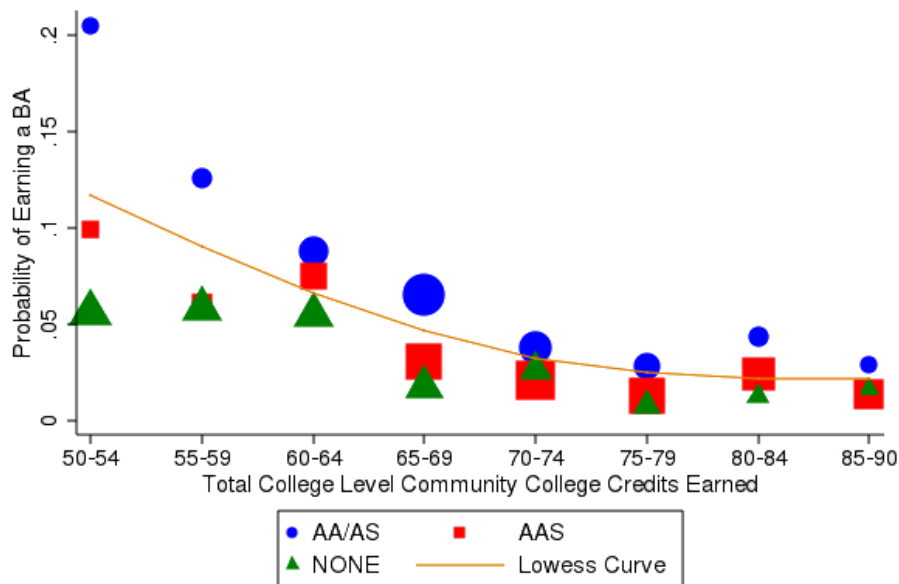
Figure 2
Distribution of College Level Community College Credits Earned:
Any Degree Versus No Degree



4.4 Credits, Associate Degrees, and Bachelor's Degrees

To preview our regression results, Figures 3–5 show how the probability of earning a bachelor's degree varies for students with different associate degrees.⁹ Probabilities are plotted for five-credit bins starting at 50 credits. The size of the plot marker is proportional to the number of students in each bin.¹⁰ Figure 3 presents the trend for the probability of earning a bachelor's degree within four years of beginning community college. Green triangle markers indicate students who have no associate degree, red square markers indicate students with an AAS degree, and blue circle markers indicate students with a transfer-oriented AA/AS degree.

Figure 3
Probability of Earning Bachelor's Degree Within Four Years
by Degree Awarded and Credits Earned



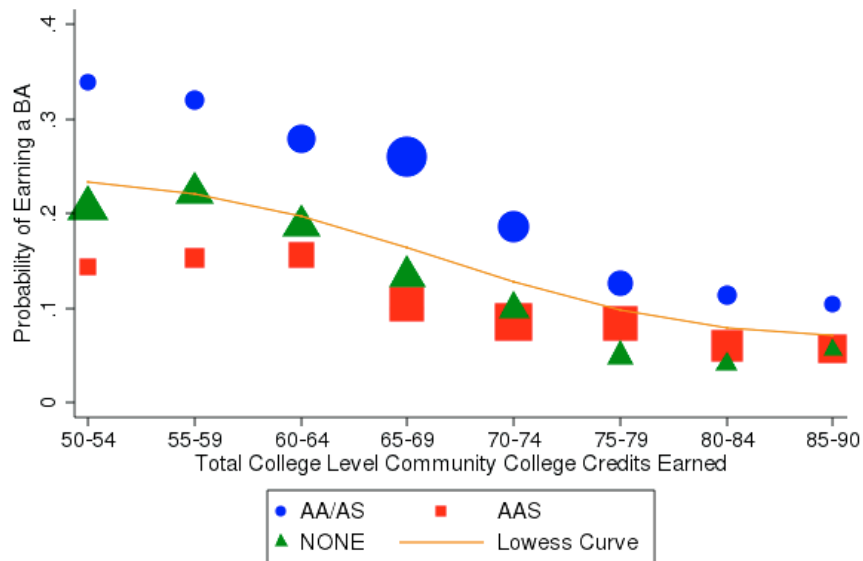
⁹ In the figures, *BA* refers to any bachelor's degree.

¹⁰ Though in theory there should not be AA/AS or AAS students in the 50–54 and 55–59 credit bins, our data have some students who fall into these credit ranges. There are several potential reasons that could explain this phenomenon. For example, (a) students may transfer credits into the state system from other colleges (credits that do not show up on their community college transcript), (b) we did not include final grades of IP (in progress) or O (Other) as passing, (c) students are not in fact FTIC but we are unable to detect it using the National Student Clearinghouse.

The probability of earning a bachelor’s degree declines as the number of credits earned at the community college increases for all groups. However, this phenomenon could be due to selection and censoring of outcomes. Students who earned more community college credits will have transferred later and thus be less likely to earn a bachelor’s degree in any specified time period. Those who earned an associate degree were more likely to earn a bachelor’s degree within four years in every credit bin.

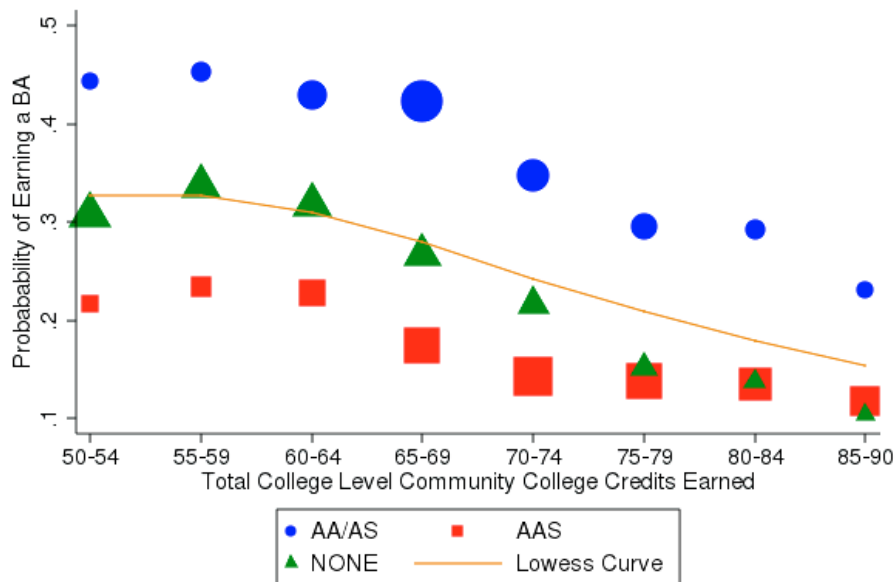
Figure 4 extends the timeframe for earning a bachelor’s degree to within five years. This figure presents a somewhat different story than Figure 3. Students in transfer-oriented (AA/AS) programs still did better than the other categories in every credit range, but the probabilities sharply fall after 74 credits. Those who transferred without an associate degree had higher graduation probabilities than AAS holders until the 80+ credit bins.

Figure 4
Probability of Earning Bachelor’s Degree Within Five Years
by Degree Awarded and Credits Earned



Finally, Figure 5 presents the probabilities for our third outcome, obtaining a bachelor’s degree within six years. The differences between students in each associate degree category are certainly magnified here, but the general pattern remains. Students who earned a college transfer associate degree had higher probabilities of earning a bachelor’s degree than both AAS holders and non-degree holders; AAS holders, however, had lower bachelor’s degree completion rates than non-degree holders in general.

Figure 5
Probability of Earning Bachelor’s Degree Within Six Years
by Degree Awarded and Credits Earned



These figures preview the regression results presented in the next section. Earning a transfer-oriented diploma before transferring to a four-year institution is associated with higher bachelor’s degree earning rates compared with earning any other credential or no credential. The low rates illustrated by AAS holders are not necessarily surprising. As noted earlier, these degrees are designed to be terminal credentials that prepare students for occupations rather than for transfer, and there is no statewide articulation agreement

that protects credits earned for AAS holders, which would incentivize bachelor's degree completion for these students.

5. Results

5.1 Logistic Regression Models

To further investigate the relationship between earning an associate degree and baccalaureate degree outcomes among transfer students, we turn to a generalized linear regression analysis to account for our dichotomous dependent variables of interest. First, we estimate logistic regression models with corresponding marginal effects, and then we present results from a comparison group generated by propensity score matching (PSM). In both sets of tables, we present three distinct models. The first model is estimated with a sample of students who earned 50–90 community college credits, and the focus is on the dummy variable that indicates whether or not the student earned any associate degree at the community college. The second model restricts the sample to students who were in a transfer-oriented (AA/AS) program during their first term of study. In this model, the focus is on the indicator variable for whether or not the student earned an AA or AS before transferring. The third model restricts the sample to students who were in AAS programs in the first term of study, and the focus is on the indicator variable for whether or not the student earned an AAS degree before transferring.¹²

Table 3 presents results of the first model for our three outcomes of interest. We find that earning an associate degree before transfer is associated with a positive and significant increase in the probability of earning a bachelor's degree within each time period. Specifically, Table 3 suggests that students holding an associate degree were 92 percent more likely to earn a BA in four years, 64 percent more likely to do so in five years and about 50 percent more likely to likely to graduate with a bachelor's degree in six years.

¹² Though we look at a student's intended program of study in her first term, it is possible that students change majors during college.

Table 3
Logistic Regression Estimates of the Odds of Earning a Bachelor's Degree
Given Associate Degree Attainment

Variable	Earned BA ⁺ Within 4 Years		Earned BA ⁺ Within 5 Years		Earned BA ⁺ Within 6 Years	
	Odds Ratio	Marginal Effect	Odds Ratio	Marginal Effect	Odds Ratio	Marginal Effect
	(1)		(2)		(3)	
Independent Variable of Interest						
Earned Any Associate Degree	1.916*** [0.197]	0.0262*** [0.00415]	1.644*** [0.0964]	0.0540*** [0.00633]	1.504*** [0.0733]	0.0633*** [0.00748]
Student Demographics						
Female	1.183* [0.112]	0.00680* [0.00381]	1.125** [0.0625]	0.0128** [0.00603]	1.023 [0.0471]	0.00348 [0.00714]
Age at Enrollment	1.022*** [0.00601]	0.000865*** [0.000238]	0.996 [0.00385]	-0.000422 [0.000420]	0.990*** [0.00318]	-0.00163*** [0.000497]
Black	0.602*** [0.0900]	-0.0205*** [0.00608]	0.522*** [0.0454]	-0.0708*** [0.00944]	0.540*** [0.0368]	-0.0957*** [0.0105]
Native American	1.012 [0.440]	0.000487 [0.0175]	0.726 [0.196]	-0.0348 [0.0294]	0.791 [0.163]	-0.0364 [0.0320]
Hispanic	0.712 [0.197]	-0.0137 [0.0112]	0.832 [0.124]	-0.0200 [0.0163]	0.904 [0.111]	-0.0156 [0.0190]
Asian	0.600* [0.170]	-0.0206* [0.0114]	0.696** [0.112]	-0.0395** [0.0174]	0.824 [0.110]	-0.0300 [0.0207]
Other	1.177 [0.311]	0.00658 [0.0107]	0.839 [0.142]	-0.0191 [0.0184]	1.052 [0.141]	0.00779 [0.0208]
LEP	1.179 [0.726]	0.00666 [0.0248]	1.195 [0.430]	0.0193 [0.0392]	0.674 [0.203]	-0.0611 [0.0468]
US Citizen	0.519*** [0.126]	-0.0264*** [0.00981]	0.518*** [0.0741]	-0.0715*** [0.0155]	0.588*** [0.0719]	-0.0823*** [0.0189]
Labor Characteristics						
Employed in First Term	0.834* [0.0773]	-0.00732* [0.00374]	0.946 [0.0530]	-0.00608 [0.00609]	0.953 [0.0440]	-0.00748 [0.00717]
Academic Preparation						
High School Diploma	1.155 [0.257]	0.00582 [0.00899]	1.091 [0.132]	0.00951 [0.0132]	0.963 [0.0957]	-0.00590 [0.0154]
Took Developmental Math	0.593*** [0.0596]	-0.0211*** [0.00408]	0.764*** [0.0450]	-0.0293*** [0.00640]	0.944 [0.0460]	-0.00886 [0.00755]
Took Developmental English	0.578*** [0.0818]	-0.0221*** [0.00574]	0.689*** [0.0519]	-0.0404*** [0.00816]	0.881** [0.0512]	-0.0196** [0.00900]
Enrollment Characteristics						
Term of Transfer	0.808*** [0.00718]	-0.00860*** [0.000436]	0.823*** [0.00420]	-0.0212*** [0.000549]	0.834*** [0.00348]	-0.0281*** [0.000550]
Total Credits Earned at the CC	0.961*** [0.00515]	-0.00162*** [0.000218]	0.967*** [0.00292]	-0.00368*** [0.000323]	0.980*** [0.00242]	-0.00312*** [0.000379]
N of Observations	13,067	13,067	13,738	13,738	13,738	13,738

Note. Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; college fixed effects included.

*For this and all subsequent tables, BA refers to any bachelor's degree.

To put these values in terms of graduation rates (as in Table 2), we present the average marginal effects as well. We find that the predicted probability of earning a bachelor's degree within four years is 2.6 percentage points greater for associate degree holders than non-holders, 5.4 percentage points greater in five years, and 6.3 percentage points greater in six years.¹³

In Tables 4 and 5, we disaggregate by program to investigate students in AA/AS programs and in AAS programs separately. For AA/AS programs, Table 4 reports coefficients on earning an associate degree that are nearly twice as large in magnitude as in Table 3. More specifically, focusing on marginal effects reveals that earning an AA or AS is associated with a 4.2 percentage point increase in bachelor's degree attainment within four years, an 8.7 percentage point increase within five years, and a 10.8 percentage point increase within six years. When looking at our sample of students in AAS programs (Table 5), however, the results tell a different story. For AAS students who transferred, earning the associate degree did not seem to have any significant impact on the likelihood of obtaining a bachelor's degree within four, five, or six years.

5.2 Propensity Score Models (PSMs)

The logit estimates presented thus far suffer from issues related to selection bias. Although we have restricted the number of credits for sample eligibility, accounted for timing of transfer, and controlled for various observable characteristics, students still selected whether or not to earn the associate degree first, and we are unable to account for all variables that influenced the selection process. One attempt at improving the comparison sample is through the PSM technique.

Table 6 reports odds ratios and marginal effects for our three models where matched samples were compared using a PSM technique. Results are similar in sign to our logistic regression results, though are now reported as ATT, or impact differences between treated and untreated students in our matched sample. As shown in Model 1, earning any associate degree corresponds with a 1.8, 3.1, and 4.0 percentage point increase in bachelor's degree attainment rates within four, five and six years, respectively, compared with non-earners.

¹³ In Table 3, one notices decreasing odds ratios and increasing marginal effects. Though this may seem contradictory to some, it is due to generally increasing completion rates over time. Whereas a two-unit difference between 2 and 4 is a 100 percent change, the difference between 22 and 24 is a 9 percent change.

Table 4
Logistic Regression Estimates of the Odds of Earning a Bachelor's Degree
Given an Associate in Arts or an Associate in Science

Variable	Earned BA Within 4 Years		Earned BA Within 5 Years		Earned BA Within 6 Years	
	Odds Ratio	Marginal Effect	Odds Ratio	Marginal Effect	Odds Ratio	Marginal Effect
	(1)		(2)		(3)	
Independent Variable of Interest						
Earned AA/AS Degree	2.341*** [0.271]	0.0421*** [0.00575]	1.912*** [0.129]	0.0872*** [0.00886]	1.815*** [0.103]	0.108*** [0.0100]
Student Demographics						
Female	1.252** [0.140]	0.0111** [0.00554]	1.229*** [0.0796]	0.0278*** [0.00867]	1.099* [0.0604]	0.0172* [0.00993]
Age at Enrollment	1.030*** [0.00743]	0.00144*** [0.000358]	0.999 [0.00508]	-0.000111 [0.000684]	0.999 [0.00441]	-0.000132 [0.000800]
Black	0.654** [0.125]	-0.0210** [0.00949]	0.545*** [0.0637]	-0.0817*** [0.0157]	0.555*** [0.0514]	-0.107*** [0.0166]
Native American	1.145 [0.631]	0.00670 [0.0273]	0.682 [0.242]	-0.0514 [0.0478]	0.759 [0.208]	-0.0499 [0.0495]
Hispanic	0.686 [0.215]	-0.0186 [0.0155]	0.852 [0.144]	-0.0215 [0.0227]	0.994 [0.141]	-0.00107 [0.0257]
Asian	0.710 [0.226]	-0.0169 [0.0157]	0.557*** [0.107]	-0.0788*** [0.0258]	0.731** [0.115]	-0.0567** [0.0285]
Other	1.361 [0.400]	0.0153 [0.0146]	0.877 [0.169]	-0.0177 [0.0259]	1.053 [0.167]	0.00933 [0.0288]
LEP	0.729 [0.578]	-0.0156 [0.0392]	1.162 [0.522]	0.0202 [0.0604]	0.598 [0.212]	-0.0930 [0.0641]
US Citizen	0.526** [0.147]	-0.0318** [0.0139]	0.503*** [0.0873]	-0.0925*** [0.0233]	0.554*** [0.0832]	-0.107*** [0.0271]
Labor Characteristics						
Employed in First Term	0.780** [0.0859]	-0.0123** [0.00546]	0.938 [0.0627]	-0.00854 [0.00898]	0.950 [0.0536]	-0.00932 [0.0102]
Academic Preparation						
High School Diploma	1.112 [0.287]	0.00524 [0.0128]	1.002 [0.136]	0.000234 [0.0183]	0.908 [0.104]	-0.0174 [0.0208]
Took Developmental Math	0.557*** [0.0660]	-0.0290*** [0.00588]	0.703*** [0.0483]	-0.0473*** [0.00916]	0.856*** [0.0499]	-0.0282*** [0.0105]
Took Developmental English	0.566*** [0.0937]	-0.0282*** [0.00823]	0.704*** [0.0626]	-0.0472*** [0.0119]	0.905 [0.0646]	-0.0181 [0.0129]
Enrollment Characteristics						
Term of Transfer	0.810*** [0.00952]	-0.0104*** [0.000671]	0.830*** [0.00548]	-0.0251*** [0.000828]	0.842*** [0.00454]	-0.0312*** [0.000806]
Total Credits Earned at the CC	0.962*** [0.00620]	-0.00193*** [0.000322]	0.964*** [0.00353]	-0.00494*** [0.000482]	0.981*** [0.00303]	-0.00344*** [0.000553]
N of Observations	7,531	7,531	7,897	7,897	7,963	7,963

Note. Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; college fixed effects included.

Table 5
Logistic Regression Estimates of the Odds of Earning a Bachelor's Degree Associate in Applied Science Degree Attainment

Variable	Earned BA Within 4 Years		Earned BA Within 5 Years		Earned BA Within 6 Years	
	Odds Ratio	Marginal Effect	Odds Ratio	Marginal Effect	Odds Ratio	Marginal Effect
	(1)		(2)		(3)	
Independent Variable of Interest						
Earned AAS Degree	1.148 [0.260]	0.00473 [0.00778]	1.214 [0.162]	0.0144 [0.00991]	1.142 [0.122]	0.0150 [0.0120]
Student Demographics						
Female	1.264 [0.273]	0.00806 [0.00738]	0.951 [0.125]	-0.00373 [0.00977]	0.883 [0.0919]	-0.0140 [0.0117]
Age at Enrollment	1.019 [0.0124]	0.000642 [0.000424]	1.009 [0.00714]	0.000645 [0.000526]	0.993 [0.00599]	-0.000761 [0.000678]
Black	0.485** [0.145]	-0.0249** [0.0104]	0.650*** [0.106]	-0.0320*** [0.0121]	0.733** [0.0926]	-0.0350** [0.0142]
Native American	1.011 [0.958]	0.000386 [0.0326]	1.038 [0.528]	0.00275 [0.0378]	1.319 [0.460]	0.0312 [0.0393]
Hispanic	0.613 [0.513]	-0.0168 [0.0287]	0.524 [0.243]	-0.0480 [0.0344]	0.692 [0.246]	-0.0414 [0.0399]
Asian	0.412 [0.326]	-0.0305 [0.0273]	1.578 [0.577]	0.0339 [0.0272]	1.425 [0.440]	0.0399 [0.0347]
Other	0.440 [0.413]	-0.0282 [0.0323]	0.732 [0.339]	-0.0232 [0.0345]	0.934 [0.321]	-0.00772 [0.0387]
LEP	1.271 [1.647]	0.00823 [0.0445]	0.846 [0.600]	-0.0124 [0.0527]	0.669 [0.450]	-0.0453 [0.0758]
US Citizen	0.636 [0.425]	-0.0155 [0.0229]	0.644 [0.216]	-0.0327 [0.0248]	0.739 [0.216]	-0.0341 [0.0328]
Labor Characteristics						
Employed in First Term	1.184 [0.247]	0.00580 [0.00715]	1.165 [0.146]	0.0114 [0.00931]	1.031 [0.104]	0.00344 [0.0113]
Academic Preparation						
High School Diploma	0.755 [0.380]	-0.00967 [0.0174]	0.888 [0.270]	-0.00885 [0.0226]	0.790 [0.182]	-0.0265 [0.0260]
Took Developmental Math	0.578** [0.141]	-0.0188** [0.00851]	0.824 [0.119]	-0.0144 [0.0107]	1.033 [0.118]	0.00361 [0.0128]
Took Developmental English	0.758 [0.233]	-0.00954 [0.0106]	0.651** [0.110]	-0.0319** [0.0126]	0.796* [0.101]	-0.0257* [0.0142]
Enrollment Characteristics						
Term of Transfer	0.797*** [0.0148]	-0.00781*** [0.000788]	0.799*** [0.00893]	-0.0167*** [0.000893]	0.813*** [0.00718]	-0.0233*** [0.000914]
Total Credits Earned at the CC	0.969*** [0.0110]	-0.00106*** [0.000390]	0.988* [0.00655]	-0.000864* [0.000492]	0.992 [0.00516]	-0.000907 [0.000584]
N of Observations	3,291	3,291	4,024	4,024	4,046	4,046

Note. Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$; * $p < 0.1$; college fixed effects included.

When restricting the sample of transfer students by type of degree earned prior to transfer, we find that the completion of an AA/AS (Model 2) is associated with larger differences in the likelihood of bachelor's degree completion than those seen in Model 1 compared with non-completers. Specifically, Model 2 indicates that students holding an AA/AS were 3.1 percentage points more likely to earn a bachelor's degree within four years, 6.2 percentage points more likely within five years, and 9.5 percentage points more likely within six years than their peers who transferred without an AA/AS degree.

Finally, the results for the AAS sample using PSM are also similar to our simple logistic regression results, inasmuch as no significant differences in the likelihood of bachelor's degree completion were found between AAS degree holders and non-holders.

Table 6
Odds Ratios of the Effect of Treatment on the Treated (ATT)

	Earned BA Within 4 Years		Earned BA Within 5 Years		Earned BA Within 6 Years	
	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects
	(1)		(2)		(3)	
<u>Model 1:</u>						
Earned Any Associate Degree	1.487*** [0.128]	0.0177*** [0.00390]	1.249*** [0.0600]	0.0311*** [0.00673]	1.218*** [0.0484]	0.0402*** [0.00809]
Observations	12,428	12,428	12,428	12,428	12,428	12,428
<u>Model 2:</u>						
Earned AA/AS	1.765*** [0.182]	0.0308*** [0.00571]	1.451*** [0.0835]	0.0617*** [0.00946]	1.517*** [0.0741]	0.0947*** [0.0109]
Observations	7,396	7,396	7,396	7,396	7,396	7,396
<u>Model 3:</u>						
Earned AAS	1.125 [0.207]	0.00381 [0.00595]	1.170 [0.126]	0.0147 [0.0101]	1.092 [0.0935]	0.0131 [0.0127]
Observations	3,674	3,674	3,674	3,674	3,674	3,674

Note. Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; college fixed effects included.

6. Sensitivity Tests

To test the robustness of the results presented here, we replicate Table 6 using three alternative sets of specifications by (1) further limiting our sample to students who transferred to a four-year institution within three years of first enrollment at the community college, (2) including a measure of overall GPA at the community college, and (3) restricting the sample to those who had between 60 and 80 community college credits before transferring.

Table 7 reports coefficients for our three models using PSM on students who transferred within three years of enrollment. We analyze this restricted sample with the expectation that they are more similar along unobserved dimensions; these students were following a more traditional path through college. Results are similar in sign to our main PSM analysis, but have increased in magnitude by up to three times in some cases. That is, when restricting to students who transferred relatively early, the impact of earning an associate degree before transferring is particularly pronounced. Specifically, Table 7, Model 1 shows that earning any associate degree, regardless of degree type, is associated with a 6.6, 11.4, and 9.2 percentage point increase in bachelor's degree attainment within four, five, and six years, respectively. Next, restricting our analysis by degree type as shown in Models 2 and 3, we find that earning transfer-oriented degrees are associated with marginal effects that are larger than earlier estimates: 9.2, 16.8, and 16.2 percentage points for four-, five-, and six-year graduation rates. Again, we generally see no impact of earning an AAS on the likelihood of earning a baccalaureate.

Table 7
Odds Ratios of the Effect of Treatment on the Treated (ATT) Among Students
Transferring Within Three Years

	Earned BA Within 4 Years		Earned BA Within 5 Years		Earned BA Within 6 Years	
	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects
	(1)		(2)		(3)	
<u>Model 1:</u>						
Earned Any Associate Degree	1.852*** [0.167]	0.0660*** [0.00968]	1.642*** [0.0982]	0.114*** [0.0134]	1.480*** [0.0852]	0.0970*** [0.0140]
Observations	4,874	4,874	4,874	4,874	4,874	4,874
<u>Model 2:</u>						
Earned AA/AS	2.315*** [0.265]	0.0925*** [0.0127]	2.053*** [0.154]	0.168*** [0.0165]	1.955*** [0.144]	0.162*** [0.0168]
Observations	3,066	3,066	3,066	3,066	3,066	3,066
<u>Model 3:</u>						
Earned AAS	1.316 [0.245]	0.0305 [0.0207]	1.472*** [0.196]	0.0835*** [0.0283]	1.327** [0.167]	0.0684** [0.0300]
Observations	1,050	1,050	1,050	1,050	1,050	1,050

Note. Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; college fixed effects included.

Table 8 reports ATT coefficients for the same sample of students used in our main analysis, but we have included overall community college GPA as an additional matching characteristic. We include college GPA as a sensitivity test rather than in our main model due to well-documented concern over grading at the postsecondary level. Research has shown that there are systematic differences in the way instructors evaluate students, related to differences in everything from the instructor’s gender to his or her faculty status (DeBoer, Anderson, & Elfessi, 2007; McArthur, 1999). In addition, we suspect that some students may be strategic in their course-taking behaviors, enrolling in certain classes or even selecting majors that are known to be easier than others (Goldman, Schmidt, Hewitt, & Fisher, 1974). This strategy may be particularly common among students looking to increase their qualifications in preparation for applying to transfer to a four-year institution. As our data do not allow us to account for these systematic differences across teachers, courses, and programs, any results relying on student grades may be subject to biases.

Table 8
Odds Ratios of the Effect of Treatment on the Treated (ATT) Using GPA as an Additional Matching Covariate

	Earned BA Within 4 Years		Earned BA Within 5 Years		Earned BA Within 6 Years	
	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects
	(1)		(2)		(3)	
<u>Model 1:</u>						
Earned Any Associate Degree	1.270*** [0.0991]	0.0105*** [0.00346]	1.259*** [0.0570]	0.0301*** [0.00591]	1.266*** [0.0469]	0.0458*** [0.00717]
Observations	15,048	15,048	15,048	15,048	15,048	15,048
<u>Model 2:</u>						
Earned AA/AS	1.567*** [0.156]	0.0254*** [0.00572]	1.595*** [0.0933]	0.0752*** [0.00935]	1.704*** [0.0843]	0.119*** [0.0107]
Observations	7,396	7,396	7,396	7,396	7,396	7,396
<u>Model 3:</u>						
Earned AAS	1.168 [0.196]	0.00495 [0.00538]	1.190* [0.119]	0.0157* [0.00906]	1.132 [0.0903]	0.0175 [0.0113]
Observations	4,450	4,450	4,450	4,450	4,450	4,450

Note. Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; college fixed effects included.

Despite these concerns, Table 8 coefficients are based on a PSM model using cumulative GPA as an additional matching covariate. Results presented in Table 8 are smaller than those found in our main PSM analysis (Table 6), although the same general patterns remain. ATT estimates that consider a measure of academic performance still show a positive relationship between earning an associate degree and the likelihood of earning a baccalaureate, with the exception of earning an AAS where no impact is uncovered.

In Table 9, we present results for a sample of students that has been further restricted by the number of credits obtained. We limit this sample to FTIC students who completed between 60 and 80 credits to ensure that our original credit restrictions were not impacting our results. As Table 9 shows, further restricting our sample by these new criteria produces ATT estimates of the same direction as those reported in Table 6, supporting the conclusions made in our main analyses.

Table 9
Odds Ratios of the Effect of Treatment on the Treated (ATT) for
Students With 60–80 Community College Credits

	Earned BA Within 4 Years		Earned BA Within 5 Years		Earned BA Within 6 Years	
	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects	Odds Ratio	Marginal Effects
	(1)		(2)		(3)	
<u>Model 1:</u>						
Earned Any Associate Degree	1.850*** [0.233]	0.0245*** [0.00517]	1.607*** [0.107]	0.0637*** [0.00895]	1.421*** [0.0763]	0.0717*** [0.0108]
Observations	6,842	6,842	6,842	6,842	6,842	6,842
<u>Model 2:</u>						
Earned AA/AS	2.034*** [0.303]	0.0307*** [0.00666]	1.725*** [0.131]	0.0843*** [0.0116]	1.622*** [0.101]	0.108*** [0.0136]
Observations	4,634	4,634	4,634	4,634	4,634	4,634
<u>Model 3:</u>						
Earned AAS	1.178 [0.276]	0.00525 [0.00753]	1.184 [0.163]	0.0158 [0.0128]	1.048 [0.113]	0.00699 [0.0162]
Observations	2,288	2,288	2,288	2,288	2,288	2,288

Note. Standard errors in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; college fixed effects included.

7. Follow-Up Analysis

Our findings lead us to ponder potential explanations differences in bachelor’s degree earning rates observed for students in our sample. While this paper does not control for the transfer’s school sector, forthcoming work on the impact of the transfer’s school sector implies an overall penalty in bachelor’s degree completion for students who transfer to for-profit colleges (Liu & Belfield, 2014). To investigate whether these differences are associated with differences in transfer destination, we map IPEDS data about the institution to where students first transferred onto each student record. We focus on measures of institutional selectivity or quality as measured by percent admitted, admissions yield, graduation rates, full-time and part-time student retention rates, and salaries for three professorial ranks (professor, associate, and assistant). We also look at institutional characteristics such as geography, sector, level of control, and size.

Comparing AA/AS earners to non-earners, we find that students with the degree seem to positively select their transfer institutions.¹⁴ Though differences are not particularly large in magnitude, AA/AS earners transferred to institutions with higher graduation and retention rates as well as higher faculty salaries. Additionally, the most important differences appear in the choice of sector and level of control of the destination college. Students in AA/AS programs tended to enroll in public and private not-for-profit institutions: only 2 percent of AA/AS holders enrolled in private for-profit colleges compared with 5 percent of non-earners. However, on the applied science side, 14 percent of AAS earners enrolled in private for-profit colleges compared with 15 percent of non-earners. When factoring baccalaureate completion (within six years) into these comparisons, we find that students in AA/AS programs who earned bachelor's degrees were more likely to be at public four-year colleges and less likely to be in private, not-for-profit, four-year colleges and for-profit colleges than students who did not earn a bachelor's degree. For students in AAS programs, of those who did not earn a bachelor's degree, 17 percent were enrolled in private, for-profit colleges, compared with three percent of AAS students who earned a bachelor's degree. These patterns remain the same when we look at, for example, AA/AS earners who also earned a bachelor's degree—none of these students earned their baccalaureate at a private, for-profit institution.

Regardless of the transfer destination, however, our work shows that AA/AS earners had higher bachelor's degree completion rates: earners had a 7 percentage point advantage at public four-year schools, a 14.6 percentage point advantage at private four-year schools, and a 5 percentage point advantage at private for-profit schools. Of AAS students who transferred to public four-year schools, 20.9 percent earned a bachelor's degree, compared with 18.9 of students who transferred to private four-year schools and 3.6 percent of students who transferred to private for-profit schools. However, the results for AAS graduates differ from those for students who earned an AA or AS: AAS earners had a 2.7 percentage point disadvantage in bachelor's degree completion at public four-year schools compared with non-earners, a 6.9 percentage point advantage at private not-for-profit four-year schools, and 1.4 percentage point advantage at private for-profit schools.

¹⁴ Detailed tables for these results are available upon request.

8. Discussion and Conclusion

Our results suggest that earning an associate degree before transferring is associated positively with earning a bachelor's degree, findings that mirror those of Crook et al. (2012). Both our matched and unmatched models find an advantage in bachelor's degree attainment for students who earned transfer-oriented AA/AS diplomas and no effect for students who earned applied associate degrees. However, it is important to remember that the results are measured on a positively selected sample of students who earned at least 50 community college credits before transferring to a four-year institution. In addition, the interpretation of these findings must take the policy context into account. This section discusses our results in light of the potential mechanisms for why we might expect an associate degree to improve various outcomes among community college transfer students: signaling, articulation and course transferability, and structure and course choice.

One potential explanation for the differences in bachelor's degree earning rates observed for students in our sample has to do with the colleges to which students transfer (Cohodes & Goodman, 2013; Liu & Belfield, 2014). For example, if students who earn the AA/AS before transfer are going to "better" four-year institutions than non-earning peers, this could play a role in their likelihood of earning the degree. Such a finding would be consistent with the signaling model.

Indeed our findings show that compared with non-earners, AA/AS students with the degree seemed to positively select their transfer institutions, as measured by institutional quality. Additionally, while students in AA/AS programs tended to enroll in public and private not-for-profit institutions, students in AAS programs were much more likely to enter a for-profit institution, regardless of associate degree status. For AA/AS students, earning the associate degree was beneficial in terms of bachelor's degree completion at all transfer destinations, but for AAS students, earning an associate degree was only associated with an advantage at private not-for-profit institutions. This suggests that there may be both direct and indirect effects of earning an associate degree: it may have influenced the type of school to which the student transferred, which then could

have influenced how the student performed, a finding that is also consistent with the signaling model.¹⁵

Our findings also lend some support for the hypothesis that the statewide articulation agreement plays a role in better outcomes for transfer students.¹⁶ Articulation-specific research has predominantly focused on the policy's impact on student transferability, a focus deemed inappropriate by Roska and Keith (2008) due to the fact that the intended purpose of such agreements is to prevent the loss of credit when students transfer within the state's higher education system. The agreement clearly rewards transfer-oriented associate degree holders by protecting their courses and awarding them junior status upon transfer. This should improve bachelor's degree completion rates because students with the degree are less likely to lose credits after transferring and less likely to have to retake courses than students who transfer without the degree. Without more detailed transcript data from originating and destination institutions, however, it is impossible to know whether this has indeed occurred. The differences in outcomes between AA/AS and AAS degree holders uncovered in this paper, however, provide some evidence that articulation agreements may be working well to support those with transfer-oriented degrees, especially if we consider the AAS students as a valid counterfactual for what it would be like for AA/AS students to not have a statewide articulation agreement. However, as mentioned earlier, there are in fact bilateral articulation agreements between certain community colleges and public four-year institutions that facilitate transfer between AAS and four-year programs. These are not available for every program, are not supported by the state, and it is not necessarily the case that the AAS degree is incentivized in these agreements (many transfer credit on a course-by-course basis). Therefore, our finding that the AA/AS degree matters for bachelor's degree completion while the AAS degree does not may be partly due to differences in articulation policies. This begs for more appropriately purposed and comprehensive research to determine how associate degree completion affects student

¹⁵ It should be noted, however, that the opportunity costs associated with AAS students may be very different from those of AA/AS students. Arguably, AAS students (and earners in particular) have valuable skill sets that are important for earning wages. Therefore, it may only be the weak AAS students, those who are unable to find employment, who transfer to four-year institutions. Such a scenario, while not necessarily at odds with a signaling hypothesis, could provide another explanation for the differences between transfer institution types uncovered in this paper.

¹⁶ Similarly, Crook et al. (2012) argued that their findings reflected the CUNY articulation agreement.

outcomes given specific elements of the articulation agreement encountered, something previous research has not yet considered (Roska & Keith, 2008).

Lastly, our findings are ambiguous in terms of implications for the hypothesis that associate degrees impact bachelor's degree completion because of the increased structure associated with coherent programs of study that lead to a degree, compared with a loose collection of potentially transferable courses. According to the structure hypothesis, community college students who are offered efficient pathways are less wasteful—they are less likely to retake college courses, less likely to deviate, even if unintentionally, away from their original academic plans and goals, and potentially less likely to be deterred by bureaucratic barriers (Scott-Clayton, 2011). Insofar as AA and AS programs are considered to be structured pathways, the estimated benefits to bachelor's degree completion associated with AA/AS completion support structure as an underlying mechanism. While we find the lack of an effect for AAS students, who are arguably in even more structured programs, the AAS may be well-structured *in itself*, but it may not be well-structured as a *transfer pathway*—and indeed we would not expect it to be, since it was not designed that way, suggesting that structure may indeed be the mechanism at work.

Our main finding that the AA/AS is important for transfer success is significant and warrants recommendations for colleges, policymakers, and students. Colleges (and perhaps districts and systems) ought to consider increasing the level of encouragement provided to students, highlighting the benefits of earning these degrees before transferring. It is important to remember, though, that earning just any associate degree may not be an appropriate recommendation. We find very different impacts when looking at the value of the AAS for transfer success compared with the value of the transfer-oriented diploma. The influence that degree completion has beyond the community college career supports the notion that the responsibility to motivate students along preferred pathways falls on both two-year and four-year institutions. Although benefits to the community college are readily apparent in certain reporting and performance incentives that reward higher completion rates, the findings presented here show that four-year institutions also gain from encouraging associate degree completion among community college students. Specifically, our findings suggest that four-year institutions

could see higher success rates for transfer students who have completed an associate degree, an important factor to consider under new accountability regimes that specifically account for transfer students. Simply stated, at the institutional level, encouraging completion for transfer-oriented students serves multiple stakeholders and multiple purposes. Increased availability and awareness of academic advising may be critical reforms for two- and four-year colleges to consider in order to encourage students to transfer with the degree.

This study provides additional support for the community college completion agenda, even for students whose ultimate goal is a bachelor's degree. For students in transfer-oriented programs, encouraging completion at the community college could lead to four-year college outcomes that are nearly 10 percentage points greater than comparable students who do not complete. Colleges should thus consider redoubling efforts to advise and encourage transfer-seeking students to earn the associate degree credential first.

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Appendix

Table A.1
Descriptive Characteristics by Program Enrollment

Variable	Total Sample	50–90 Credits			
	(1)	All (2)	None (3)	AA/AS (4)	AAS (5)
	<i>Mean</i>	<i>Mean</i>	<i>Mean</i>	<i>Mean</i>	<i>Mean</i>
Earned Associates	24.6%	54.8%	45.5%	46.4%	54.8%
Student Demographics					
Female	61.0%	61.4%	75.3%	56.1%	66.1%
Age at Enrollment	24.9	24.5	25.9	22.7	27.7
White	59.0%	68.2%	56.6%	76.2%	57.5%
Black	31.1%	21.6%	32.7%	13.2%	33.5%
Native American	1.5%	1.5%	2.6%	1.2%	1.8%
Hispanic	3.6%	3.3%	3.1%	3.4%	3.0%
Asian	2.2%	2.9%	2.6%	3.3%	2.1%
Other	2.6%	2.6%	2.5%	2.8%	2.1%
LEP	0.4%	0.6%	0.6%	0.6%	0.8%
US Citizen	97.4%	96.6%	95.9%	96.5%	97.3%
Labor Characteristics					
Employed in First Term	59.0%	58.6%	56.0%	60.2%	56.7%
Academic Preparation					
HS Diploma	94.7%	94.7%	94.1%	94.1%	96.1%
Took Dev Math	45.3%	52.5%	54.7%	52.1%	52.3%
Took Dev English	26.8%	26.8%	30.4%	23.8%	31.3%
Took Any Dev	50.9%	57.7%	59.2%	57.6%	57.2%
Enrollment Characteristics					
Time of First Transfer	17.1	17.7	19.5	16.4	19.4
CC Credits Earned	39.1	67.8	68.9	66.3	70.2
Total Students	40,975	13,744	1,713	7,968	4,063