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Should Community College Students Earn an Associate Degree Before Transferring to a 4-Year Institution?

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Abstract Using data on over 41,000 students in one state who entered community college before transferring to a 4-year institution, this study examines the following question: Are community college students who earn an associate degree before transferring to a 4-year college more likely to earn a bachelor's degree? Due to the causal nature surrounding this question we employ several strategies to minimize selection bias, including the use of propensity score matching. Analysis reveals large, positive apparent impacts of earning the transfer-oriented associate degrees (i.e., Associate in Arts and Associate in Science) on the probability of earning a bachelor's degree within 6 years. We do not find any apparent impacts associated with earning one of the workforce-oriented degrees (i.e., Associate in Applied Science) 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.

Keywords Community colleges · Associate degree completion · Transfer · Bachelor's degree completion · Propensity score matching

Introduction

Community colleges are the postsecondary entry point for thousands of students each year in the United States. Over 80 % of these students indicate a desire to earn a bachelor's degree or higher (Horn and Skomsvold 2011). However, according to studies by the National Student Clearinghouse (NSC), only about 15 % of all students who start at 2-year

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colleges earn a bachelor's degree within 6 years (Shapiro et al. 2012). Although the expected pathway for community college students seeking a bachelor's degree includes earning an associate degree, few rigorous studies on the value of the associate degree or its impact on bachelor's degree completion have been published. This paper thus seeks to better and more accurately answer the following question: Are community college students who earn an associate degree before transferring to a 4-year college more likely to earn a bachelor's degree?

Due to the causal nature surrounding this central research question, researchers encounter a range of analytical challenges. Simple comparisons of 4-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 are 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 degree and outcomes after transfer. Thus it is not clear whether any difference in outcomes is largely due to earning the 2-year credential or whether such differences are attributable to other confounding factors or unobserved characteristics.

In an attempt to minimize this selection problem, this paper employs multiple strategies that we believe improve upon previous attempts to answer the question at hand. 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 4-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 associate degree [i.e., Associate in Arts (AA) or Associate in Science (AS)] and the probability of earning a bachelor's degree within 6 years. However, we do not find any apparent impacts associated with earning one of the workforce-oriented degrees [i.e., Associate in Applied Science (AAS)] 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.

A further advantage of this study over prior literature is our consideration of the potential mechanisms driving our results. Although not the motivating purpose of this study, we hypothesize and, when the data allow, briefly explore several explanations for differential impacts on bachelor's degree attainment by associate degree type. We hope that this post hoc discussion encourages a more rigorous analysis of mechanisms through which the associate degree can benefit transfer students.

The organization of this paper is as follows: "Literature Review" section reviews the literature on associate degrees, transfer, and bachelor's degree attainment; "Empirical Strategy" section discusses our empirical strategy; "Data" section introduces the data and descriptive statistics; "Results" section reports results; "Sensitivity Tests" section reports sensitivity tests; and "Discussion and Conclusion" section discusses potential mechanisms, policy implications, and concludes the paper.

Literature Review

Foundations

Although there has been growing interest in determining whether the pre-transfer credential is important or not (Crook et al. 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 4-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 4-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]

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 (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 4-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 and Page 1996; Belfield and 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 and Smith 2004).

Unfortunately, very little research has been conducted on the signaling value of an associate degree to the 4-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 a substantial portion of transfer students who have bachelor's degree intentions do not earn an associate degree before transferring (Hoachlander et al. 2003). A report conducted by the NSC, for example, found that only 64 % of students transferring from 2- to 4-year institutions actually earned an

[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.

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 2- and 4-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 and Calcagno 2010). Furthermore, and more relevant to the present study, research also shows that higher credit accumulation increases the likelihood of baccalaureate completion among community college transfer students (Koker and Hendel 2003). Doyle (2006), for instance, found that 82 % of students who were able to utilize all of their pre-transfer credits graduated within 6 years of transfer, as compared with only 42 % of their peers who were unable to use all of their pre-transfer credits at their 4-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, insomuch 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, 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 and Fletcher 2014; Kadlec and Martinez 2013).

Previous Work

Though much has been written about transfer in community colleges (see Belfield and 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 and Wilson 2006; Carlan and Byxbe 2000; Glass Jr. and Harrington 2002; Melguizo et al. 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 2- and 4-year institutions called *articulation agreements* (Roksa and Keith 2008; Gross and Goldhaber 2009; Anderson et al. 2006). However, these studies have 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 % points) of earning a 4-year degree within 3 years than students without the degree. They found a smaller association (15 % points) for students who earned the vocationally oriented AAS degree before transferring. Although they did not specifically control for the number of credits earned in the community college, 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 4-year institutions considered. In addition, county average unemployment rates and average annual earnings during the 3 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 4 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 2-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 % 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.

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 and Cho 2013). Financial considerations might also impact student decisions. Attending a community college before 4-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 and 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 and 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 (Roksa and 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).

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.

Empirical Strategy

Estimating the effect of earning an associate degree at the community college before transferring to a 4-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 4 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 the community colleges 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 4-year institutions. Such characteristics may be observable in the dataset, such as age or gender, but, undoubtedly, there are also a number of unobserved, but equally important characteristics that can help explain the decision over whether to earn a credential. Included among these unobserved influences are factors such as financial need, employment intensity, educational motivation, and academic capacity.

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 governs the transfer of credits between all community colleges, public 4-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 starting positions at the 4-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 4-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

[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.

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 et al. 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, proxies for ability, and community college attended. Students in the sample are randomly sorted before employing nearest neighbor matching without replacement within a caliper width of $c = 0.25\sigma_p$, where σ_p is equal to the standard deviation of the propensity score.[4] This method of matching is implemented with the goals of constructing 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). It should be noted that despite controlling for a wide array of student and academic characteristics through the use of PSM, we are unable to control for various unobserved influences on the decision to obtain an associate degree such as educational motivation, financial considerations, organizational skills, and academic capacity. While we acknowledge that the methods employed cannot account for all relevant factors underlying selection into or out of degree completion, we are able to show that our matching strategy successfully reduces bias. Still, the failure to account for these unobservables should not go unnoticed, as any results may continue to suffer from the selection biases we aim to eliminate.

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.

Even after taking steps to increase similarity across our sample, students will differ according to their associate degree completion status, which provides variation for the study at hand. There are several reasons students with comparable numbers of credits may differ along this dimension. Some students, for example, may have opted to avoid or may not have been aware of the non-pecuniary costs and institutional barriers associated with graduation (Cross 1981). That is, eligible or near-eligible students may fail to receive their degree, not because of any academic requirement that they cannot meet, but rather because they did not want to incur, did not understand or may not have budgeted time for the administrative steps necessary for formal degree completion. Additionally, it is also

[4] Research confirms that appropriate calipers can substantially reduce bias. Although a review of the literature reveals a lack of consensus as to the most desirable caliper width, $0.25\sigma_p$ is widely accepted as the recommended choice (Lunt 2014) based on Rosenbaum and Rubin's (1985) article "Constructing a Control Group Using Multivariate Matched Sampling Methods that Incorporate the Propensity Score".

important to note that the accumulation of credit hours necessary for degree completion does not indicate that the student has successfully satisfied particular course requirements. This distinction may be particularly relevant for major-switchers who in earlier terms may have enrolled in courses that no longer count towards their current program's course requirements (Capaldi et al. 2006). Alternatively, students may have failed to adequately follow the curriculum of a degree-granting program due to frustrations and confusion over postsecondary educational pathways (Person et al. 2006; Jenkins and Cho 2013) or a lack of motivation to seek out information on specific program requirements (Rosenbaum et al. 2006). Still others potentially always lacked interest in obtaining an associate degree, even under the presupposition of eventual transfer (Horn and Nevill 2006).

Because associate degree status is not exogenous, factors which influence the decision to graduate may also explain any observed differences in bachelor degree completion rates. Community college students who are turned off by increased bureaucratic procedures, have a tendency to veer off track, or are prone to difficulties in the face of increased educational autonomy, for example, may be likely to demonstrate similar traits and patterns at the university level. Similarly, those students who complete associate degree requirements may also be those who are most likely to successfully persist through the bachelor degree program. In other words, it is reasonable to expect that students will display comparable levels of resolve in the face of external challenges post-transfer (Wang 2012). A failure to control for these differences may result in an upward bias on the estimated impact of associate degree status on bachelor degree completion. The observational data used here, however, does not allow us to unpack or control for these potential mechanisms impacting decisions over associate degree completion. Despite this limitation, we remain confident that our results approach truer estimates than those previously uncovered by less rigorous methods.

Data

The data for this study come from a community college system in a single state.[5] We track about 41,000 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 4-year institution within 6 years of entering community college. We consider that a student has transferred if she has any enrollment in a 4-year institution, public or private, after enrollment in community college (we exclude students who were enrolled at a 4-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 (LEP) status, high school diploma, citizenship, employment status in the first term, and proxies for ability as determined by enrollment in developmental education courses.

The outcome of interest is whether or not the student earned a baccalaureate (any bachelor of arts or bachelor of science degree) within 6 years of starting community college.[6] Bachelor's degree data are retrieved from the NSC based on a match that the state system performed using unique student identifiers.

[5] The system under study consists of approximately 60 community colleges and 20 universities.

[6] Six years is considered to be the standard length of time for baccalaureate completion, as it is 150 % of the expected time to degree for first-time, full-time students.

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 which rely on balancing the distribution of observable characteristics among treatment and control groups. Thus, we cannot interpret our results as causal and we must also consider the possibility that our results are still subject to bias induced by remaining unobservable characteristics underlying a student's selection to obtain or not obtain a certain degree before transfer that are not accounted for by the matching algorithm employed here. 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 4-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.[7] 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 completion. The fact that students must have transferred to a 4-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 information may bias results in an ambiguous way, suggesting that any apparent impacts uncovered may actually be greater or smaller 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.[8]

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 first two columns contain all students who transferred to a 4-year institution. The next six columns focus on students who earned 50–90 community college (non-developmental) credits, those in our analysis sample. We present statistics for all 13,803 of these students and then break them down by declared program of study in the first term—either a transfer-oriented

[7] 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 (e.g., 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.

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

Table 1 Descriptive characteristics by degree status among transfer students

	Total sample		50–90 credits					
	Earned any associate	Did not earn associate	All		AA/AS		AAS	
			Earned any associate	Did not earn associate	Earned AA/AS	Did not earn AA/AS	Earned AAS	Did not earn AAS
Student demographics								
Female	65.3 %	59.6 %	64.0 %	58.3 %	58.4 %	54.0 %	69.1 %	62.4 %
Age at enrollment	25.6	24.6	25.3	23.6	23.2	22.2	29.0	26.1
White	68.5 %	55.9 %	68.9 %	67.4 %	77.9 %	74.7 %	56.3 %	58.8 %
Black	21.6 %	34.2 %	21.3 %	21.9 %	11.9 %	14.3 %	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 %	3.3 %	3.5 %	2.5 %	3.7 %
Asian	2.5 %	2.1 %	2.5 %	3.2 %	3.1 %	3.5 %	1.4 %	2.9 %
Other	2.5 %	2.7 %	2.5 %	2.7 %	2.7 %	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	58.9 %	59.0 %	58.8 %	58.3 %	59.9 %	60.5 %	56.9 %	56.4 %
Academic characteristics								
HS diploma	96.8 %	94.0 %	96.7 %	92.2 %	96.8 %	91.7 %	97.0 %	94.9 %
Took developmental math	50.0 %	43.8 %	52.0 %	53.2 %	52.7 %	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 %

Table 1 continued

	Total sample		50–90 credits					
	Earned any associate	Did not earn associate	All		AA/AS		AAS	
			Earned any associate	Did not earn associate	Earned AA/AS	Did not earn AA/AS	Earned AAS	Did not earn AAS
Enrollment characteristics								
Time of transfer	18.0	16.8	17.8	17.5	16.3	16.5	19.3	19.4
CC credits earned	74.0	27.6	70.6	64.3	68.3	64.6	72.2	67.8
Community college GPA	3.21	2.87	3.20	2.98	3.19	2.98	3.28	3.04
Total students	10,177	30,880	7585	6218	3680	4245	2225	1838

program (AA/AS) or a workforce-oriented associate in applied science (AAS) program that is not specifically designed for college transfer.[9] Descriptive statistics for each group together are presented in Table 7 (Appendix).[10]

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 and Black students more highly represented 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. 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-earning 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 were 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).[11] 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 more likely to be female, more racially diverse, and older than their AA/AS counterparts. Within AAS students, those who earned the associate degree were 3 years older than those who did not. Finally, AAS earners appear to have been more positively selected academically—they had higher high school diploma earning rates and lower rates of taking developmental education than AA/AS earners. This is the prototypical profile of the older, mature, focused, vocationally oriented community college student.

A visual representation of the relationship between the probability of earning a bachelor's degree within 6 years and the number of community college credits for each of the aforementioned groups is depicted in Fig. 1. Generally speaking, there is a positive relationship (at least for the first 60 credits) between accumulating community college credits

[9] Students must select a program of study upon applying to the college and are therefore formally declared by the time the students begins his or her studies. Though AAS programs are not designed for college transfer, several 2- and 4-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.

[10] Comparing the first two columns of Table 7 in Appendix 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 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 5 years of study.

[11] Although we focus on students entering into an AA/AS or AAS program in their first term, some students initially enroll in Associate of Fine Arts (AFA), certificate, or diploma programs. We do not present separate analyses for these students, in part, due to small sample sizes. For example, only 59 of the 98 transfer students who initially enrolled in an AFA program and earn 50–90 non-developmental community college credits obtained an AFA.

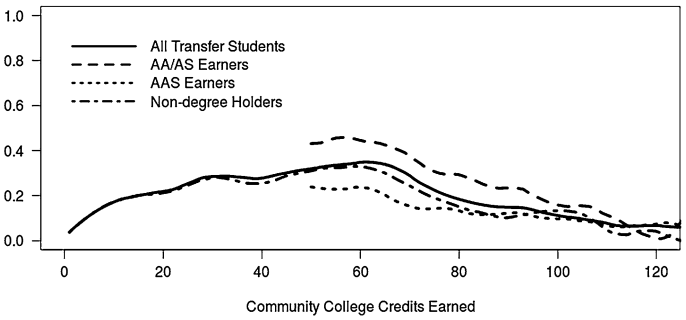

Fig. 1 Relationship between the probability of earning a bachelor's degree within 6 years and the number of community college credits earned

and the probability of obtaining a bachelor's degree within 6 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 have a bachelor's degree completion rate that is almost 20 % 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.

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.[12] The first row indicates that among all transfer students included in our sample, over one quarter earned a degree within 6 years. There is a small, 2 % point difference in rates between associate degree earners and non-earners. Rates were higher among students in transfer-oriented (AA/AS) programs and lower among students in AAS programs; about 35 % of AA/AS program participants earned a bachelor's degree within 6 years, compared to only about 18 % of students enrolled in AAS programs.

While the completion rates presented in Table 2 are substantially lower than those reported by the NSC (Shapiro et al. 2013), it should be noted that the NSC looks at completion rates 5 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 2-year college within the 4 years prior to their first enrollment at a 4-year institution, which could include students who were admitted to 4-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.

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

[12] Although we only discuss 6-year outcomes, we also looked at the relationship between earning an associate degree and bachelor's degree attainment within 4 and 5 years of entering the community college. Even after limiting the time of observation we generally find similar, though slightly attenuated, relationships to the 6-year outcomes presented here.

Table 2 Summary of bachelor's degree* completion rates by program enrollment (among transfer students with 50–90 community college credits)

	Earned a bachelor's degree within 6 years	N
Any degree program	27.8 %	13,803
Associate	28.7 %	7585
No associate	26.7 %	6218
AA/AS program	35.4 %	7925
AA/AS	40.5 %	3680
No AA/AS	31.0 %	4245
AAS program	17.8 %	4063
AAS	17.9 %	2225
No AAS	17.5 %	1838

* For this and all subsequent tables *Bachelor's Degree* refers to any baccalaureate credential (including bachelor of arts, bachelor of science, etc.)

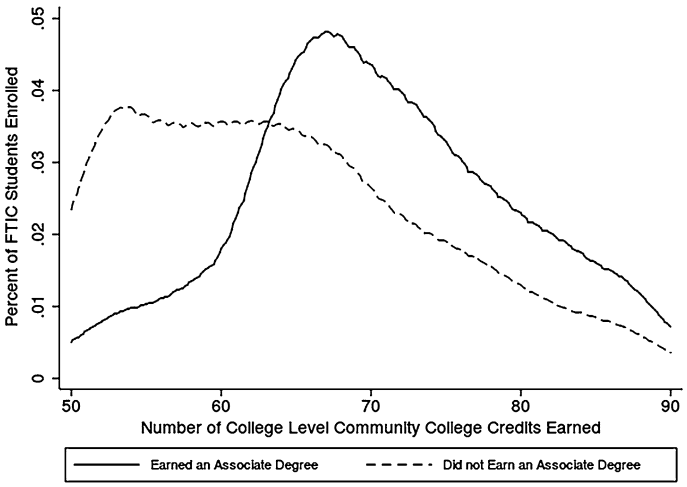

Fig. 2 Distribution of college-level community college credits earned among transfer students by associate degree status

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.

Credits, Associate Degrees, and Bachelor's Degrees

Figure 3 presents the trend for the probability of earning a bachelor's degree within 6 years of beginning community college for students with different associate degrees. Probabilities

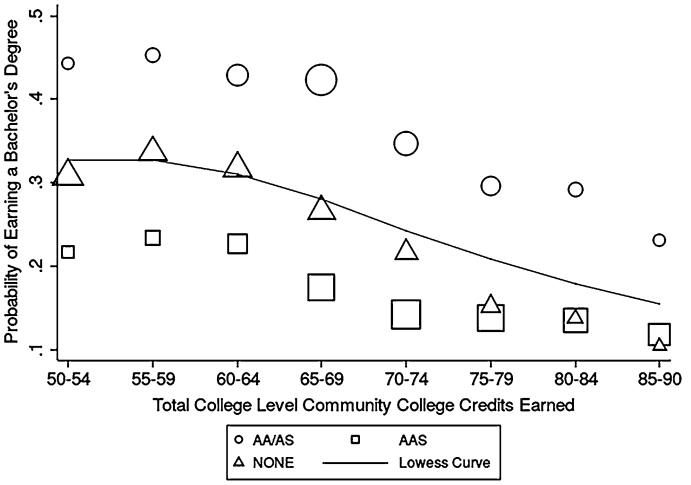

Fig. 3 Probability of earning a bachelor's degree within 6 years by degree awarded and credits earned

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.[13] Triangle markers indicate students who have no associate degree, square markers indicate students with an AAS degree, and circle markers indicate students with a transfer-oriented AA/AS degree. 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 6 years in every credit bin.

Figure 3 previews the regression results presented in the next section. Earning a transfer-oriented diploma before transferring to a 4-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.

[13] 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, and (c) some students may not in fact be FTIC but we were unable to detect previous postsecondary enrollments using the National Student Clearinghouse.

Results

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 analyses, we include 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.[14]

Table 3 presents results for each of the three models and our three outcomes of interest. In Model 1, columns 1 and 2, 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 6 years of first enrollment. Specifically, our results suggest that students holding an associate degree are about 50 % more likely to likely to graduate with a bachelor's degree in 6 years. 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 6 years is 6.3 % points greater for associate degree holders than non-holders.

In Models 2 and 3, we disaggregate by program to investigate students in AA/AS programs and in AAS programs separately. For AA/AS programs, Model 2 reports coefficients on earning an associate degree that are nearly twice as large in magnitude as those reported under Model 1. More specifically, focusing on marginal effects reveals that earning an AA or AS is associated with a 10.8 % point increase within 6 years. When looking at our sample of students in AAS programs (Model 3), 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.

Propensity Score Models

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. In order to reduce bias and variablity

[14] Though we look at a student's intended program of study in his or 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 within 6 years (among transfer students with 50–90 community college credits)

	Model 1: Earned any associate degree		Model 2: Earned AA/AS		Model 3: Earned AAS	
	Odds ratio (1)	Marginal effect (2)	Odds ratio (3)	Marginal effect (4)	Odds ratio (5)	Marginal effect (6)
Independent variable of interest	1.502***	0.063***	1.817***	0.108***	1.142	0.015
	(0.072)	(0.007)	(0.103)	(0.010)	(0.119)	(0.012)
Student demographics						
Female	1.023	0.003	1.101*	0.018*	0.883	−0.014
	(0.046)	(0.007)	(0.060)	(0.010)	(0.090)	(0.011)
Age at enrollment	0.990***	−0.002***	0.999	−0.000	0.993	−0.001
	(0.003)	(0.000)	(0.005)	(0.001)	(0.006)	(0.001)
Black	0.538***	−0.096***	0.546***	−0.110***	0.733**	−0.035**
	(0.037)	(0.011)	(0.051)	(0.017)	(0.093)	(0.014)
Native American	0.782	−0.038	0.759	−0.050	1.319	0.031
	(0.162)	(0.032)	(0.206)	(0.049)	(0.547)	(0.047)
Hispanic	0.902	−0.016	1.011	0.002	0.692	−0.041
	(0.112)	(0.019)	(0.149)	(0.027)	(0.224)	(0.036)
Asian	0.825	−0.030	0.728**	−0.058**	1.425	0.040
	(0.109)	(0.020)	(0.115)	(0.029)	(0.426)	(0.034)
Other	1.051	0.008	1.052	0.009	0.934	−0.008
	(0.140)	(0.021)	(0.170)	(0.029)	(0.303)	(0.037)
LEP	0.676	−0.061	0.593	−0.095	0.669	−0.045
	(0.209)	(0.048)	(0.242)	(0.074)	(0.399)	(0.067)
US citizen	0.588***	−0.082***	0.546***	−0.110***	0.739	−0.034
	(0.073)	(0.019)	(0.084)	(0.028)	(0.208)	(0.032)

Table 3 continued

	Model 1: Earned any associate degree		Model 2: Earned AA/AS		Model 3: Earned AAS	
	Odds ratio (1)	Marginal effect (2)	Odds ratio (3)	Marginal effect (4)	Odds ratio (5)	Marginal effect (6)
Labor characteristics						
Employed in first term	0.955	−0.007	0.944	−0.011	1.031	0.003
	(0.044)	(0.007)	(0.053)	(0.010)	(0.102)	(0.011)
Academic characteristics						
HS diploma	0.968	−0.005	0.912	−0.017	0.790	−0.027
	(0.095)	(0.015)	(0.105)	(0.021)	(0.188)	(0.027)
Took developmental math	0.941	−0.009	0.857***	−0.028***	1.033	0.004
	(0.046)	(0.008)	(0.050)	(0.011)	(0.117)	(0.013)
Took developmental English	0.878**	−0.020**	0.895	−0.020	0.796*	−0.026*
	(0.051)	(0.009)	(0.063)	(0.013)	(0.102)	(0.014)
Enrollment characteristics						
Term of transfer	0.835***	−0.028***	0.842***	−0.031***	0.813***	−0.023***
	(0.004)	(0.001)	(0.005)	(0.001)	(0.008)	(0.001)
CC credits earned	0.980***	−0.003***	0.981***	−0.003***	0.992	−0.001
	(0.002)	(0.000)	(0.003)	(0.001)	(0.005)	(0.001)
Total students	13,797	13,797	7895	7895	4046	4046

Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; College fixed effects included

remaining in our estimates due to differences in observed characteristics, we employ a PSM technique. PSM selects treatment and comparison pairs with similar values across the linear combination of all matching variables. As a result, the balance of covariates improves between the two groups.

Table 4 shows the distribution of observables across treatment and control groups after the matching algorithm was employed separately for all students within the 50–90 credit range, as well as for each subgroup of interest. With the exception of the average age at the time of enrollment for all students, we do not observe any significant differences between the treatment and comparison groups in each of the three samples considered. The percent bias reduction, or the reduction in the expected difference for each covariate between treatment and comparison groups after matching is reported in columns 4, 8 and 12 and confirms that our matching technique resulted in a more balanced sample. Even in the case of age, our matching algorithm successfully and satisfactorily minimizes differences between associate degree holders and non-holders as evidenced by the fact that bias was reduced by nearly 75 %. Any remaining statistically significant differences across groups can be at least partially explained by our large sample size.

Table 5 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 3.4 % point increase in bachelor's degree attainment rates within 6 years, compared with non-earners. 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 8.9 % points more likely to earn a bachelor's degree within 6 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, insomuch as no significant differences in the likelihood of bachelor's degree completion were found between AAS degree holders and non-holders.

Sensitivity Tests

To test the robustness of the results presented in "Propensity Score Models" section, in Table 6 we replicate Table 5 using three alternative sets of specifications: (1) limiting our sample to students who transferred to a 4-year institution within 3 years of first enrollment at the community college, (2) including a measure of overall GPA at the community college to our matching algorithm, and (3) restricting the sample to those who had between 60 and 80 community college credits before transferring. Table 8 though Table 10 in the Appendix report the distributions of student characteristics resulting from each alternative PSM specification. The results confirm that across all sensitivity tests our matching techniques successfully reduced bias and achieved greater balance between treatment and

Table 4 Balanced characteristics by program enrollment (among transfer students with 50–90 community college credits)

	Any				AA/AS				AAS			
	(1) Treatment	(2) Control	(3) Difference	(4) Bias reduction	(5) Treatment	(6) Control	(7) Difference	(8) Bias reduction	(9) Treatment	(10) Control	(11) Difference	(12) Bias reduction
Student demographics												
Female	58.4 %	59.5 %	−1.1 %	80.9 %	55.3 %	56.6 %	−1.3 %	71.1 %	64.2 %	65.6 %	−1.4 %	78.9 %
Age at enrollment	23.4	23.9	−0.5***	74.5 %	22.5	22.7	−0.2	81.3 %	26.6	27.1	−0.5	82.5 %
White	68.4 %	68.2 %	0.2 %	83.8 %	76.3 %	77.0 %	−0.7 %	78.4 %	58.6 %	58.0 %	0.6 %	75.6 %
Black	21.2 %	21.4 %	−0.1 %	80.5 %	13.1 %	12.3 %	0.8 %	68.0 %	32.5 %	33.1 %	−0.5 %	88.8 %
Native American	1.2 %	1.4 %	−0.1 %	49.4 %	1.0 %	1.1 %	−0.1 %	9.4 %	1.7 %	1.6 %	0.1 %	62.0 %
Hispanic	3.4 %	3.4 %	0.0 %	100.0 %	3.4 %	3.4 %	0.0 %	74.2 %	3.2 %	3.2 %	0.1 %	94.5 %
Asian	2.9 %	2.9 %	0.0 %	100.0 %	3.5 %	3.4 %	0.1 %	86.5 %	1.8 %	1.7 %	0.1 %	95.5 %
Other	2.8 %	2.8 %	0.0 %	81.5 %	2.8 %	2.8 %	0.0 %	71.5 %	2.0 %	2.4 %	−0.3 %	−881.0 %
LEP	0.7 %	0.7 %	0.0 %	100.0 %	0.6 %	0.5 %	0.1 %	−1106.1 %	0.7 %	0.9 %	−0.3 %	45.7 %
US citizen	96.6 %	96.6 %	0.0 %	98.8 %	96.6 %	97.2 %	−0.6 %	38.7 %	97.2 %	97.5 %	−0.3 %	73.6 %
Labor characteristics												
Employed in first term	59.2 %	58.1 %	1.1 %	−115.0 %	60.6 %	59.5 %	1.1 %	−89.9 %	56.4 %	56.6 %	−0.2 %	59.9 %
Academic characteristics												
HS diploma	95.6 %	96.0 %	−0.4 %	91.2 %	96.5 %	96.1 %	0.4 %	92.6 %	95.8 %	96.2 %	−0.5 %	77.1 %
Took developmental math	52.4 %	52.9 %	−0.5 %	61.0 %	52.5 %	53.1 %	−0.6 %	51.9 %	53.5 %	53.5 %	0.1 %	99.4 %
Took developmental English	27.6 %	27.4 %	0.2 %	91.4 %	24.2 %	23.7 %	0.5 %	85.4 %	31.5 %	32.4 %	−0.9 %	81.0 %
Total students	5634	5634			3194	3194			1487	1487		

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 5 Odds ratios of the average treatment effect on the treated (ATT) (among transfer students with 50–90 community college credits)

	Model 1: Earned any associate degree		Model 2: Earned AA/AS		Model 3: Earned AAS	
	Odds ratio (1)	Marginal effects (2)	Odds ratio (3)	Marginal effects (4)	Odds ratio (5)	Marginal effects (6)
Treatment received	1.187***	0.034***	1.481***	0.089***	1.053	0.007
	(0.050)	(0.008)	(0.078)	(0.012)	(0.102)	(0.014)
Total students	11,268	11,268	6388	6388	2974	2974

Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 6 Odds ratios of the average treatment effect on the treated (ATT)

	Model 1: Earned any associate degree		Model 2: Earned AA/AS		Model 3: Earned AAS	
	Odds ratio (1)	Marginal effects (2)	Odds ratio (3)	Marginal effects (4)	Odds ratio (5)	Marginal effects (6)
Panel 1: transferring within 3 years[a]						
Treatment received	1.284***	0.062***	1.602***	0.115***	1.137	0.031
	(0.083)	(0.016)	(0.128)	(0.019)	(0.182)	(0.039)
Total students	3812	3812	2582	2582	636	636
Panel 2: GPA as additional matching variable[a]						
Treatment received	0.952	−0.010	1.212***	0.192***	0.920	−0.083
	(0.042)	(0.009)	(0.065)	(0.053)	(0.091)	(0.099)
Total students	10,324	10,324	6120	6120	2810	2810
Panel 3: transfer students with 60−80 CC credits						
Treatment received	1.249***	0.044***	1.584***	0.102***	1.122	0.019
	(0.070)	(0.011)	(0.106)	(0.015)	(0.131)	(0.018)
Total students	6472	6472	4044	4044	1908	1908

Standard errors in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

[a] Only transfer students who have earned 50–90 community college credits are included

comparison groups. Even among the limited set of covariates for which we observed small yet statistically significant differences between treatment and control groups after matching,[15] bias was reduced by between 54 and 82 %.

[15] After including GPA as an additional matching covariate, we observed significant differences in age (−0.5 years) and GPA (−0.04 points) among all students within the 50–90 credit range. Using the same matching algorithm on AAS program participants a statistically significant difference in age of 0.6 years remained. After matching, however, these biases were reduced by 74.2, 81.5, and 78.4 %, respectively. Additionally, when restricting our entire sample to students who earned 60–80 community college credits, regardless of initial program enrollment, the comparison group was significantly more likely to be female (2.4 %) and about 0.5 years older than their peers. The balance of these characteristics across groups,

Panel 1 of Table 6 reports coefficients for our three models using PSM on students who transferred within 3 years of enrollment. We expect this specification to accomplish two important tasks. First, we analyze this restricted sample with the expectation that students are more similar along unobserved dimensions; these students were following a more traditional path through college. Thus, the sample restriction seeks to further minimize unobserved sources of selection bias that arguably still remained as a result of the matching algorithm in the main PSM analysis. Second, this strategy seeks to reduce any potential that our definition of transfer, as opposed to degree status, is driving our results. Finding similar results as before would provide valuable evidence in support of the internal validity of our study.

Results are similar in sign to our main PSM analysis, but have increased in magnitude. That is, when restricting to students who transferred relatively early, the impact of earning an associate degree before transferring is particularly pronounced. Specifically, Table 6, Panel 1 shows that earning any associate degree, regardless of degree type, is associated with a 6.2 % point increase in bachelor's degree attainment within 6 years. Next, restricting our analysis by degree type, as shown in Models 2 and 3, we find that earning transfer-oriented degrees is associated with marginal effects that are larger slightly than earlier estimates: 11.5 % points for 6-year graduation rates. Again, we generally see no impact of earning an AAS on the likelihood of earning a baccalaureate.

Panel 2 reports ATT coefficients for the same sample of students used in our main analysis, but we include 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 et al. 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 et al. 1974). This strategy may be particularly common among students looking to increase their qualifications in preparation for applying to transfer to a 4-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.

Despite these concerns, we use cumulative GPA as an additional matching covariate in an attempt to increase internal validity by approximating and controlling for remaining underlying sources of selection bias such as the capacity for college-level education. Interestingly, although the estimated impact of holding any associate degree on the probability of bachelor's degree attainment is in the same direction as our main results, the coefficient is no longer significant after matching on academic performance. However, ATT estimates presented in Panel 2 do suggest a significantly positive relationship between earning an AA/AS degree and the likelihood of earning a baccalaureate degree within 6 years; AA/AS graduates are approximately 21 % more likely to earn a bachelor's degree than their non-graduating peers. Finally, no impact is uncovered for AAS degree completion.

In Panel 3 we present results for a sample of students that has been further restricted by the number of credits obtained. Again, we seek to increase internal validity by further minimizing potential sources of selection bias that arguably still remained as a result of the matching algorithm in the main PSM analysis. Specifically, we limit this sample to FTIC

Footnote 15 continued
however, was significantly improved as evidenced by bias reductions of 53.5 and 64.7 %, respectively. No differences between comparison and control groups were observed when limiting our sample to students who transferred within the first three years of community college enrollment.

students who completed between 60 and 80 credits to ensure that our original credit restrictions were not impacting our results. As Panel 3 shows, further restricting our sample by these new criteria produces ATT estimates of the same direction as those reported in Table 5, supporting the conclusions made in our main analyses.

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. Our findings lead us to ponder explanations for the differences in bachelor's degree earning rates by associate degree type. This section discusses our results in light of the potential mechanisms for why we might expect the AA/AS to improve various outcomes among community college transfer students: signaling, articulation and course transferability, structure and course choice, and unobserved factors.

Signaling

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 and Goodman 2013; Liu and Belfield 2014). For example, if students who earn the AA/AS before transfer are going to "better" 4-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.

To investigate whether these differences are associated with differences in transfer destination, we map Integrated Postsecondary Education Data System (IPEDS) data about the institution to which 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.[16] 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 % of AA/AS holders enrolled in private for-profit colleges compared with 5 % of non-earners. However, on the applied science side, 14 % of AAS earners enrolled in private for-profit colleges compared with 15 % of non-earners. When factoring baccalaureate completion (within 6 years) into these comparisons, we find that students in AA/AS programs who earned bachelor's degrees were more likely to be at public 4-year colleges and less likely to be in private, not-for-profit, 4-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 % were enrolled in private, for-profit colleges, compared with 3 % of

[16] Detailed tables for these results are available upon request.

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 % point advantage at public 4-year schools, a 14.6 % point advantage at private 4-year schools, and a 5 % point advantage at private for-profit schools. Of AAS students who transferred to public 4-year schools, 20.9 % earned a bachelor's degree, compared with 18.9 % of students who transferred to private 4-year schools and 3.6 % 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 % point disadvantage in bachelor's degree completion at public 4-year schools compared with non-earners, a 6.9 % point advantage at private not-for-profit 4-year schools, and 1.4 % point advantage at private for-profit schools. The implication here is that the value of an associate degree may not be in the knowledge or preparation that the college aims to impart, but rather in the degree's potential to place its holder in a transfer institution which is more likely to foster success.

These findings suggest the importance of educating policymakers and practitioners with the fact that all transfer destinations are not equal, and that the quality of transfer, not just the transfer itself, can have important implications in the success of students. Future researchers would be well advised to utilize these preliminary findings as a departure point in any analysis seeking to understand the relationship between associate degree completion and its impact on bachelor's degree outcomes in order to generate substantial and convincing evidence on the important links between associate degree completion, transfer quality, and bachelor's degree success.

Articulation and Course Transferability

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.[17]

Our findings also lend some support for the hypothesis that the statewide articulation agreement plays a role in better outcomes for transfer students.[18] Articulation-specific research has predominantly focused on the policy's impact on student transferability, a focus deemed inappropriate by Roksa and Keith (2008) due to the fact that the intended

[17] It should be noted, however, that the opportunity costs for AAS students may be very different than those potentially encountered by AA/AS students. Arguably. AAS students (and earners in particular) have valuable skill sets that can earn wages. As such, 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 in transfer institution type uncovered here.

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

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 4-year institutions that facilitate transfer between AAS and 4-year programs. These are not available for every program and 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 outcomes given specific elements of the articulation agreement encountered, something previous research has not yet considered (Roksa and Keith 2008).

Structure and Course Choice

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, 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. Future practitioners are thus encouraged to be deliberate in the purpose and goal of any pathway, considering intended outcomes and likely consequences throughout the entire course of each student's intended postsecondary trajectory.

Unobserved Factors

As previously mentioned, despite our best efforts to minimize bias due to unobservable student characteristics, the quasi-experimental methods employed do not eliminate the possibility that unobserved factors are influencing the measured differences in outcomes between students who did and did not receive an associate degree before transferring. To

be more specific, unobservable characteristics that may determine whether or not a student selects to obtain the degree before transferring may arise through differences in motivation, organization, ability, intelligence, and social and cultural capital (access to information through social networks). For example, more motivated or organized students may select to complete the AA/AS degree before transfer, while less motivated or organized students in AA/AS programs may decide to not obtain the credential. A similar argument may be made for students with different ability levels or levels of social capital. Students motivated to obtain the associate degree credential may also be more motivated to obtain the baccalaureate compared to their less motivated peers, and so our estimates on the impact of AA/AS receipt may still be confounded by a set of unobservable traits that systematically differ between groups.

Quasi-experimental methods explicitly match groups on observable characteristics, but they can only account for potential bias introduced by unobservable characteristics such as motivation to the extent that the unobservable traits are correlated with the observables (a correlation which is, in fact, unknown). Therefore, even after the matching procedure, we cannot be certain that the effects measured in our analysis are free of selection bias. Of course, any set of quasi-experimental results must be interpreted with caution, as causality cannot be certain. It is possible that our estimates represent an upper bound on true impacts, as unobserved motivation and ability are likely to be positively correlated with the probability of obtaining the AA/AS as well as the bachelor's degree and thus will introduce upward bias into our estimates.

Conclusion

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 2- and 4-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 4-year institutions also gain from encouraging associate degree completion among community college students. Specifically, our findings suggest that 4-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 2- and 4-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 4-year college outcomes that are nearly 10 % points greater than those of 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, at least in states with strong articulation agreements.

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Appendix

See Tables 7, 8, 9 and 10.

Table 7 Descriptive characteristics by program enrollment among transfer students

	Total sample	50–90 credits			
	(1) Mean	All (2) Mean	AA/AS (3) Mean	AAS (4) Mean	Other (5) Mean
Earned any associate	24.8 %	55.0 %	52.2 %	64.2 %	46.1 %
Student demographics					
Female	61.0 %	61.4 %	56.0 %	66.1 %	74.3 %
Age at enrollment	24.9	24.9	24.5	22.7	27.7
White	59.0 %	68.2 %	76.2 %	57.4 %	57.7 %
Black	31.1 %	21.6 %	13.2 %	33.5 %	31.5 %
Native American	1.5 %	1.5 %	1.5 %	1.2 %	1.8 %
Hispanic	3.5 %	3.3 %	3.4 %	3.0 %	3.2 %
Asian	2.2 %	2.8 %	3.3 %	2.1 %	2.4 %
Other	2.6 %	2.6 %	2.8 %	2.1 %	2.6 %
LEP	0.4 %	0.6 %	0.6 %	0.8 %	0.6 %
US citizen	97.4 %	96.7 %	96.5 %	97.3 %	96.0 %
Labor characteristics					
Employed in first term	59.0 %	58.9 %	58.6 %	60.2 %	56.7 %
Academic characteristics					
HS diploma	94.7 %	94.7 %	94.1 %	96.1 %	94.2 %
Took developmental math	45.3 %	45.3 %	52.5 %	52.1 %	52.3 %
Took developmental English	26.8 %	26.8 %	26.8 %	23.8 %	31.3 %
Enrollment characteristics					
Time of transfer	17.1	17.1	17.7	16.4	19.4
CC credits earned	39.1	39.1	67.8	66.3	70.2
Community college GPA	2.96	3.10	3.08	3.17	3.05
Total students	41,057	13,803	7925	4063	1815

Table 8 Balanced characteristics by program enrollment (among students transferring within 3 years of first enrollment)

	Any				AA/AS				AAS			
	(1) Treatment	(2) Control	(3) Difference	(4) Bias reduction	(5) Treatment	(6) Control	(7) Difference	(8) Bias reduction	(9) Treatment	(10) Control	(11) Difference	(12) Bias reduction
Student demographics												
Female	55.6 %	57.3 %	−1.7 %	69.3 %	54.7 %	56.9 %	−2.2 %	66.0 %	58.5 %	57.2 %	1.3 %	45.5 %
Age at enrollment	22.862	23.019	−0.157	91.3 %	22.3	22.5	−0.2	87.1 %	25.4	26.0	-0.6	79.8 %
White	77.2 %	77.4 %	−0.2 %	86.5 %	80.4 %	80.9 %	−0.5 %	81.3 %	69.8 %	71.1 %	−1.3 %	−14.8 %
Black	12.5 %	12.5 %	0.0 %	100.0 %	9.6 %	9.6 %	0.0 %	100.0 %	21.7 %	20.1 %	1.6 %	57.8 %
Native American	1.0 %	1.2 %	−0.2 %	55.5 %	1.1 %	1.1 %	0.0 %	100.0 %	1.9 %	0.9 %	0.9 %	−473.1 %
Hispanic	3.0 %	2.9 %	0.1 %	11.8 %	2.7 %	2.6 %	0.1 %	81.8 %	2.8 %	3.1 %	−0.3 %	75.9 %
Asian	3.3 %	3.1 %	0.2 %	84.5 %	3.3 %	2.9 %	0.4 %	64.4 %	1.9 %	2.5 %	−0.6 %	81.0 %
Other	2.9 %	2.9 %	0.1 %	93.5 %	2.9 %	2.9 %	0.0 %	100.0 %	1.9 %	2.2 %	−0.3 %	−785.7 %
LEP	0.7 %	0.6 %	0.2 %	−35.7 %	0.7 %	0.7 %	0.0 %	100.0 %	0.3 %	0.6 %	−0.3 %	64.5 %
US citizen	96.5 %	97.1 %	−0.5 %	73.3 %	96.7 %	97.1 %	−0.3 %	76.9 %	96.9 %	96.5 %	0.3 %	83.9 %
Labor characteristics												
Employed in first term	58.3 %	57.6 %	0.7 %	−25.5 %	59.5 %	58.0 %	1.5 %	52.3 %	56.0 %	56.0 %	0.0 %	100.0 %
Academic characteristics												
HS diploma	96.1 %	96.5 %	−0.5 %	91.4 %	96.5 %	96.7 %	−0.2 %	95.6 %	96.5 %	97.8 %	−1.3 %	74.3 %
Took developmental math	38.6 %	39.3 %	−0.7 %	79.1 %	40.7 %	40.5 %	0.2 %	−173.8 %	34.0 %	32.4 %	1.6 %	90.2 %
Took developmental English	16.0 %	16.0 %	0.1 %	98.9 %	16.0 %	17.1 %	−1.2 %	66.7 %	14.8 %	14.5 %	0.3 %	96.2 %
Total students	1906	1906			1291	1291			318	318		

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Only transfer students who have earned 50–90 community college credits are included

Table 9 Balanced characteristics by program enrollment (GPA included as an additional matching variable)

	Any				AA/AS				AAS			
	(1) Treatment	(2) Control	(3) Difference	(4) Bias Reduction	(5) Treatment	(6) Control	(7) Difference	(8) Bias Reduction	(9) Treatment	(10) Control	(11) Difference	(12) Bias Reduction
Student demographics												
Female	58.9 %	60.2 %	−1.3 %	76.7 %	56.0 %	56.8 %	−0.8 %	83.1 %	64.3 %	65.0 %	−0.7 %	89.4 %
Age at enrollment	23.5	24.0	−0.5**	74.2 %	22.6	22.7	−0.1	93.2 %	26.5	27.1	−0.6*	78.4 %
White	68.0 %	68.4 %	−0.4 %	70.0 %	75.8 %	76.6 %	−0.8 %	76.4 %	59.4 %	58.4 %	0.9 %	62.6 %
Black	21.4 %	21.2 %	0.2 %	75.7 %	13.2 %	12.8 %	0.4 %	84.7 %	31.5 %	32.7 %	−1.3 %	73.4 %
Native American	1.2 %	1.4 %	−0.2 %	30.9 %	1.0 %	1.1 %	−0.1 %	5.5 %	1.7 %	1.6 %	0.1 %	59.8 %
Hispanic	3.5 %	3.3 %	0.2 %	−15.5 %	3.5 %	3.3 %	0.2 %	−61.9 %	3.3 %	3.2 %	0.1 %	94.2 %
Asian	3.1 %	3.0 %	0.0 %	97.1 %	3.5 %	3.3 %	0.3 %	43.6 %	2.0 %	1.7 %	0.3 %	81.0 %
Other	2.9 %	2.7 %	0.2 %	−10.9 %	2.9 %	2.8 %	0.1 %	40.6 %	2.2 %	2.3 %	−0.1 %	−315.3 %
LEP	0.8 %	0.6 %	0.1 %	−531.5 %	0.6 %	0.6 %	0.0 %	100.0 %	0.8 %	0.6 %	0.1 %	71.2 %
US citizen	96.4 %	96.4 %	0.0 %	100.0 %	96.5 %	96.8 %	−0.3 %	73.0 %	97.2 %	97.0 %	0.1 %	88.8 %
Labor characteristics												
Employed in first term	58.4 %	58.4 %	0.0 %	92.4 %	60.2 %	60.3 %	−0.1 %	83.5 %	56.7 %	55.9 %	0.7 %	−41.6 %
Academic characteristics												
HS diploma	95.2 %	95.0 %	0.2 %	95.2 %	96.2 %	95.5 %	0.7 %	86.5 %	95.9 %	96.1 %	−0.1 %	93.1 %
Took developmental math	53.1 %	52.6 %	0.6 %	50.9 %	52.2 %	52.8 %	−0.6 %	52.5 %	53.3 %	53.2 %	0.1 %	98.6 %
Took developmental English	28.4 %	27.4 %	1.0 %	54.8 %	24.3 %	23.8 %	0.5 %	84.8 %	31.2 %	31.9 %	−0.6 %	86.0 %
Community college GPA	3.03	3.07	−0.04***	81.5 %	3.10	3.12	−0.02	89.6 %	3.13	3.16	−0.03	89.7 %
Total students	5162	5162			3060	3060			1405	1405		

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Only transfer students who have earned 50–90 community college credits are included

Table 10 Balanced characteristics by program enrollment (among transfer students with 60–80 community college credits)

	Any				AA/AS				AAS			
	(1) Treatment	(2) Control	(3) Difference	(4) Bias reduction	(5) Treatment	(6) Control	(7) Difference	(8) Bias reduction	(9) Treatment	(10) Control	(11) Difference	(12) Bias reduction
Student demographics												
Female	56.5 %	58.9 %	−2.4 %*	53.5 %	54.5 %	55.1 %	−0.6 %	80.8 %	62.6 %	64.0 %	−1.5 %	79.9 %
Age at enrollment	23.1	23.6	−0.5**	64.7 %	22.2	22.4	−0.1	82.3 %	26.3	26.7	−0.4	85.9 %
White	67.2 %	68.1 %	−0.9 %	53.6 %	75.2 %	76.0 %	−0.7 %	80.5 %	59.2 %	58.5 %	0.7 %	83.9 %
Black	21.7 %	21.4 %	0.3 %	65.8 %	13.9 %	13.4 %	0.5 %	78.1 %	31.1 %	32.6 %	−1.5 %	81.6 %
Native American	1.6 %	1.5 %	0.2 %	−1496.0 %	1.1 %	1.0 %	0.1 %	49.7 %	1.9 %	2.0 %	−0.1 %	−47,266.9 %
Hispanic	3.9 %	3.5 %	0.4 %	−6.5 %	3.7 %	3.3 %	0.3 %	9.5 %	3.6 %	3.0 %	0.5 %	55.9 %
Asian	3.2 %	3.1 %	0.1 %	91.2 %	3.5 %	3.5 %	0.0 %	100.0 %	1.9 %	1.5 %	0.4 %	75.8 %
Other	2.4 %	2.5 %	0.0 %	22.5 %	2.5 %	2.8 %	−0.2 %	−37.5 %	2.3 %	2.4 %	−0.1 %	79.4 %
LEP	0.9 %	0.7 %	0.2 %	−22.6 %	0.5 %	0.5 %	0.0 %	100.0 %	0.6 %	0.8 %	−0.2 %	71.7 %
US citizen	95.9 %	96.1 %	−0.2 %	87.7 %	96.3 %	96.8 %	−0.4 %	42.8 %	97.0 %	97.3 %	−0.3 %	73.3 %
Labor characteristics												
Employed in first term	58.8 %	59.2 %	−0.4 %	−259.0 %	61.7 %	60.3 %	1.4 %	−2.6 %	57.2 %	56.9 %	0.3 %	12.5 %
Academic characteristics												
HS diploma	94.5 %	94.9 %	−0.4 %	90.9 %	95.5 %	95.6 %	−0.1 %	97.3 %	95.4 %	96.0 %	−0.6 %	71.6 %
Took developmental math	55.1 %	54.7 %	0.4 %	71.6 %	53.5 %	53.7 %	−0.2 %	87.3 %	55.8 %	54.8 %	0.9 %	92.0 %
Took developmental English	29.8 %	29.4 %	0.4 %	87.3 %	27.4 %	25.2 %	2.2 %	27.0 %	33.2 %	32.4 %	0.8 %	84.2 %
Total students	3236	3236			2022	2022			954	954		

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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