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Are Community College Transfer Students “a Good Bet” for 4-Year Admissions? Comparing Academic and Labor-Market Outcomes Between Transfer and Native 4-Year College Students

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ABSTRACT

Using detailed administrative data from Virginia, this paper examines whether community college “vertical transfer” students who resemble “native four-year” students in their accumulated college-level credits and performance at their point of entry into the four-year sector perform equally well in terms of both academic and labor market outcomes. We compare matching strategies typically used in existing literature to one where we match vertical transfer and native four-year students based on prior credits earned, accumulative GPA, and the destination four-year institution, and find substantial differences in estimates based on different matching strategies. We also examine potential mechanisms underlying vertical transfer students’ relative performance at the four-year institution and in the labor market. The results show that vertical transfer students’ probability of baccalaureate attainment is comparable to that of similar native students attending the same four-year institution. However, when considering their earnings eight years after initial college enrollment, vertical transfer students experience a significant and nontrivial earnings penalty. Subsequent analyses examining possible mechanisms suggest the earning decrement is partly due to a delayed entry into the labor market as a result of credit loss at the point of transfer.

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Introduction

Each year, community colleges provide a key point of access to postsecondary education for millions of low-income and ethnic-minority students. More than half of low-income students, approximately half of Hispanic students, and about one third of African American students begin their college careers at a 2-year institution (National Center for Public Policy and Higher Education, 2011). Although the majority of community college students

aspire to a bachelor's degree, less than a quarter transfer to a 4-year institution (Horn & Skomsvold, 2011). Accordingly, the transfer process represents a strong screening mechanism, such that only the strongest and most motivated community college students ever arrive on a 4-year institution's campus (Jenkins & Fink, 2016). Yet, even though some students are able to navigate the transfer process and eventually enroll in a 4-year institution, many 4-year college faculty and administrators are still skeptical regarding the academic preparation of incoming community college transfer students. This perspective may negatively impact the reception and performance of such students at their new 4-year institution destinations.

In this study, we examined whether community college “vertical-transfer” students who resembled “native 4-year” students in their accumulated college-level credits and performance at their point of entry into the 4-year sector performed equally well in terms of both academic and labor-market outcomes. We also examined potential mechanisms underlying vertical-transfer students' relative performance at the 4-year institution and in the labor market using a novel data set that matched student college administrative records from all 2-year and 4-year colleges in an entire state to students' labor-market earnings records. We first review the conceptual underpinnings of the notion of “transfer shock,” which posits that vertical-transfer students tend to struggle relative to their new peers at a 4-year destination college, and then we review empirical evidence on this national issue.

Elements of transfer shock: Student preparation, integration, and reception

In the 1960s, Hills (1965) advanced the “transfer shock” hypothesis that community college students are often overwhelmed by the academic challenges of their new 4-year college setting and thus perform poorly or drop out. Based on primarily descriptive work from the period, Hills noted that community college transfer students typically experienced a drop in grades at the point of transfer, and thus, their grades at their new college were lower than those of their new peers; in addition, vertical-transfer students were less likely to graduate from their 4-year colleges, and those who graduated took longer to graduate than native 4-year students. Hills hence hypothesized that community colleges have more generous grading standards, weaker faculty, or inadequate facilities. Though there was no empirical evidence to bolster any of these hypotheses in particular, many 4-year faculty accepted Hills's notion that entering vertical-transfer students—even those who had college transcripts that appeared on paper to be as strong as those of the institutions' own continuing native students—were academically inferior.

In the intervening years, research on transfer shock primarily revolved around the responsibility of the community college in students' *preparation* and the role of student characteristics in terms of their own *integration* upon arrival; however, recent work has focused more closely on the role of 4-year colleges in terms of transfer students' *reception*. Next, we briefly review each of these three issues.

First, in terms of students' *preparation* by the community college, several (primarily descriptive or small-scale) studies have shown that vertical-transfer students experience a temporary drop in grade point average (GPA) at the point of transfer, suggesting that they struggle academically in the new environment (see Bahr, Toth, Thirolf, & Masse, 2013). However, due to the logistical difficulties of comparing curricula and grading standards across colleges, researchers have been unable to ascertain whether the culprit is inferior academic preparation by the sending community college (e.g., see Diaz, 1992). Rather than examining academic preparation per se, most studies of community college transfer preparation have focused on the structural or logistical aspects of transfer. Given large advisor caseloads and limited resources, community colleges usually cannot systematically provide the level of personalized advising to support student exploration and selection of a program of study, development of a transfer plan, and monitoring of student progress (Bailey, Jaggars, & Jenkins, 2015; Karp, 2013). Their students typically have little assistance with the many logistical challenges of selecting and transferring to a 4-year school, and they find the process frustrating and bewildering (Bailey, Jenkins, & Leinbach, 2005; Jaggars & Fletcher, 2014; Kadlec & Gupta, 2014; Kadlec & Martinez, 2013). Even many academically successful community college students opt not to transfer, demonstrating the substantial logistical work required to navigate the vertical-transfer process (Monaghan & Attewell, 2015). This body of evidence suggests that only the most organized and motivated community college students successfully transfer to a 4-year institution. However, it remains unclear whether these highly motivated students are as academically prepared as their new peers who are continuing at the 4-year college.

Second, in terms of students' *integration* at the new 4-year institution, most studies of transfer student adjustment have relied on the closely related frameworks of student integration, which focuses on students' identification with the new campus's academic and social norms (Tinto, 1975); student involvement, which focuses on students' academic and social behaviors (Astin, 1999); and student engagement, which focuses on those behaviors thought to be most strongly tied to eventual academic success at the college (Kuh, 2009). Studies built upon these frameworks have shown that transfer students often feel overwhelmed by the large class sizes and impersonal organizational structures of their destination college and have difficulty connecting socially with native 4-year students, who have preformed social

groups and are often less diverse than transfer entrants (Davies & Dickmann, 1998; Flaga, 2006; Harbin, 1997; Laanan, 1996; Owens, 2010; Reyes, 2011; Townsend & Wilson, 2006, 2009). Such challenges could negatively impact transfer students' academics—for example, by making it difficult for them to identify and join study groups (Kuh, 2009).

Studies of integration and engagement have typically focused on students' own characteristics and how those characteristics affect academic behaviors and related outcomes. In contrast, recent work has focused more closely on the responsibility of 4-year colleges to provide a welcoming *reception* for community college transfer students (Handel, 2011; Ruiz & Pryor, 2011; Wyner, Deane, Jenkins, & Fink, 2016). Compared with efforts surrounding first-time freshmen, the typical 4-year college does very little to recruit, welcome, and acclimate transfer students to the college (Eggleston & Laanan, 2001; Wyner et al., 2016). Many transfer students are also unpleasantly surprised to discover they must retake some of their completed community college requirements at their new destination. One national study showed that for 14% of vertical-transfer students, the 4-year institution accepted almost none of their community college credits, while the 4-year college accepted almost all credits for only 58% of students (Monaghan & Attewell, 2015). Such credit loss has strong negative consequences: In Monaghan and Attewell's (2015) study, students who were able to transfer most or all their credits had 2.5 times greater odds of graduating within 6 years than those who transferred less than half their credits.

Impacts of transfer shock: Do vertical-transfer students perform equally well as native 4-year students?

Until recently, quantitative studies documenting transfer shock have focused on early GPA or persistence at the destination college, and they have typically been descriptive, with few or no controls for pretransfer academic or background characteristics (e.g., Cejda, Kaylor, & Rewey, 1998; Diaz, 1992). More recent work comparing the outcomes of vertical-transfer and native 4-year students has used more rigorous methods and has moved beyond an examination of early outcomes and instead focused on the more distal and policy-relevant outcomes of bachelor's degree completion and labor-market returns.

Recent studies focusing on baccalaureate attainment (Bowen, Chingos, & McPherson, 2009; Glass & Harrington, 2002; Jones & Lee, 1992; Lee, Mackie-Lewis, & Marks, 1993; Melguizo & Dowd, 2009; Melguizo, Kienzl, & Alfonso, 2011; Monaghan & Attewell, 2015) have shown that once a student successfully transfers to a 4-year college, his or her probability of earning a bachelor's degree is fairly comparable to that of a native 4-year student. Studies focusing on labor-market outcomes (Brown & Xia, 2016; Hilmer, 2000; Leigh & Gill, 2003; Light & Strayer, 2004; Miller, 2007) have resulted in more

mixed findings, as we will discuss in more detail. However, both sets of studies have been subject to two major methodological limitations.

First, almost all these studies used national survey data sets, which have small sample sizes for individual institutions; accordingly, studies have typically used an across-institution matching strategy to compare vertical-transfer students to native 4-year students—a strategy that does not take into account the possibility that transfer students choose to attend different types of 4-year institutions than those of native 4-year matriculants. Studies on the community college pathway to the baccalaureate (e.g., Long & Kurlaender, 2009; Monaghan & Attewell, 2015) have further restricted their 4-year entrant sample to those who attended nonselective or minimally selective 4-year institutions on the assumption that there is little to no overlap between 2-year entrants and selective college attendees. However, recent national data showed that 53% of vertical-transfer students attended moderately selective 4-year institutions and 17% attended highly selective 4-year institutions (Jenkins & Fink, 2016). Accordingly, sample restrictions based on college selectivity may not necessarily result in “fair” comparisons.

Second, to make vertical-transfer students more comparable to native 4-year students, previous studies have restricted their samples based on idiosyncratic definitions of “successful” transfers. For example, Melguizo et al. (2011) required that vertical-transfer students first earn at least 59 college-level credits at a community college, and Monaghan and Attewell (2015) required that they first earn 48 credits. These transfer students were then compared to native 4-year college students who attained a similar threshold of credits. However, high pretransfer credit thresholds may remove a substantial proportion of the vertical-transfer population from the analysis and thus may limit the generalizability of the findings.

Indeed, Monaghan and Attewell (2015) found that only 47% of students who transferred from a community college to a 4-year college earned 60 or more credits prior to transfer, and in other studies, the typical vertical-transfer student had accumulated as few as 39 credits (Crosta & Kopko, 2014) or even 27 credits (Melguizo, Hagedorn, & Cypers, 2008) at the time of transfer. Accordingly, a high credit-accumulation threshold could remove a substantial proportion of the vertical-transfer population from analysis.

A few studies have examined the labor-market outcomes of vertical-transfer students, and they typically have concluded that the community college pathway to the baccalaureate imposes little to no labor-market penalty (Brown & Xia, 2016; Hilmer, 2000; Leigh & Gill, 2003; Light & Strayer, 2004; Miller, 2007). On the other hand, two studies suggested that the longer eventual baccalaureate earners stay at a 2-year institution, the less likely they are to reap the full labor-market rewards that would be typical for a graduate from their 4-year university (Brown & Xia, 2016; Hilmer, 2000).

In contrast to studies of baccalaureate earning—which, as noted, typically have imposed a pretransfer credit threshold and therefore intrinsically included information from students' post-college-entry (but pretransfer) period—studies of labor-market outcomes have used only pre-college-entry background characteristics as controls. With only pre-college-entry characteristics available, one cannot ascertain whether vertical-transfer students are similar to native 4-year college students in terms of their academic progress at the point of transfer. As a result, the extent to which the receiving 4-year institution may contribute to any estimated difference in labor-market earnings between transfer and native students remains unknown.

The current study

In this study, we compared degree attainment and short-term labor-market performance between vertical-transfer students and native 4-year students using detailed administrative data from Virginia. Rather than restricting the sample to those who achieved an arbitrary number of accumulated credits, we included all vertical-transfer students in our analysis and matched them to native 4-year students based on their actual number of previous credits and GPA earned at the point of transfer and based on the destination 4-year institution. These conditions enabled us to answer the following question: Is a given student at a 4-year college who has a given GPA and credit accumulation at the beginning of a particular term more likely to be successful if he has just arrived from a community college or if he has earned that same record while at the 4-year institution? With the detailed administrative data, we also explored the extent of initial GPA decline at the point of transfer as well as the eventual extent of excess credit accumulation, which may reflect credit loss at the point of transfer.

The results showed that vertical-transfer students' probability of baccalaureate attainment was comparable to that of similar native students attending the same 4-year institution. However, when considering their earnings 8 years after initial college enrollment, vertical-transfer students experienced a significant and nontrivial earnings penalty. Subsequent analyses examining possible mechanisms suggested the earning decrement was partly due to a delayed entry into the labor market as a result of credit loss at the point of transfer. Transfer students also typically experienced a decline in GPA immediately at the point of transfer, from which they later partially recovered, suggesting that transfer students may have difficulty adjusting to their new environment upon initial arrival at the receiving 4-year institution.

Methods

Data and setting

Data for our analysis were provided by the State Council of Higher Education for Virginia (SCHEV), which also provided matched data from the National Student Clearinghouse (NSC) and from Virginia's Unemployment Insurance (UI) records. The SCHEV data set encompasses data from the Virginia Community College System (which includes 23 public community colleges on 40 campuses), 1 transfer-oriented public junior college, 15 public 4-year institutions, and 31 private nonprofit 4-year institutions within the state of Virginia. The system includes a mix of large and small schools and institutions located in rural, suburban, and urban settings within a diverse geographic region. Among the 4-year institutions, the Integrated Postsecondary Education Data System (IPEDS) categorizes approximately half as selective, one third as more selective, and the remainder as inclusive. State legislation encourages formal articulation agreements between community colleges and their key 4-year transfer destinations (Va. Code Ann., 2006), but there is no statewide articulation framework. Collectively, these colleges enrolled approximately 70,000 students during the fall of 2004, with approximately half enrolled in a 2-year institution.

The SCHEV data set included demographic data, transcript records, and degree attainment information for first-time-in-college, credit-seeking students who initially enrolled in any of the included Virginia colleges in fall 2004. The NSC data set provided student enrollment and award data for non-SCHEV colleges, and the Virginia UI database provided quarterly wage records from the first quarter of 2004 to the last quarter of 2012, 8 years after college entry. Missing quarterly earnings (which could be due to nonemployment, employment in a nonreporting industry, or employment out of state) were treated as missing rather than converted to zeroes (which would assume nonemployment).

Table 1 describes the characteristics of students enrolled in any of the data set's colleges in 2004. Compared with a national sample,¹ Virginia students were more likely to be Black and less likely to be Hispanic; among 4-year entrants, Virginia students were more likely to be female and younger than 20 years of age.

Sample

Our analyses focused on students who ever attended a 4-year college, including both vertical-transfer students and native students. We defined vertical-transfer students as those who attended only a community college during their first term, who were at least 18 years of age in that term (to exclude high school students who were dual-enrolled in community college courses), and who eventually enrolled in a 4-year college. The analytic sample included

Table 1. Characteristics of students in the State Council of Higher Education for Virginia (SCHEV) database compared with a nationally representative sample of students in higher education.

Characteristic	National Sample ^a		SCHEV	
	2-Year Entrants	4-Year Entrants	2-Year Entrants	4-Year Entrants
Portion of sample	52%	39%	45%	55%
College entry term	Fall 2003	Fall 2003	Fall 2004	Fall 2004
Demographic characteristics				
Gender				
Female	59%	45%	57%	55%
Male	41%	55%	43%	45%
Race/ethnicity				
Black	18%	10%	24%	17%
Hispanic	18%	10%	6%	3%
White	56%	69%	63%	68%
Other	8%	11%	7%	12%
Age upon entry				
Average age	—	—	23.4	18.1
19 years or younger	52%	90%	53%	97%
20–23 years	18%	5%	17%	2%
24–29 years	12%	2%	12%	< 1%
30 years or older	19%	3%	18%	< 1%
Academic attributes and outcomes				
Took any developmental education	25%	17%	57%	5%
Baccalaureate-seeking upon enrollment	37%	100%	56%	100%
Highest award attained in 6 years				
Bachelor's	9%	63%	9%	70%
Associate	15%	3%	12%	1%
Certificate or diploma	16%	1%	4%	< 1%
No award	61%	33%	75%	29%
Institutional characteristics				
% starting in open-access or inclusive colleges ^b	—	—	98%	12%
Average total price of attendance (2012) ^c	—	—	\$9,343	\$33,218
Observations	8,451	6,284	31,418	38,259

Note. Precise average age was not available for the national sample; the data set reports ages in categories.

^aData derived from the Beginning Postsecondary Students Longitudinal Study (BPS:2009) using the National Center for Education Statistics (NCES) QuickStats tool. The BPS:2009 contains student-level data on a nationally representative sample of students who entered college in 2003–2004 and were tracked to 2009.

^bTwo percent of vertical-transfer students first attended a 2-year branch campus of a selective university.

^cDerived from Integrated Postsecondary Education Data System data on colleges' total price for each year from 2004 to 2012, converted into 2012 dollars.

42,803 students, approximately 10% of whom ($N = 4,678$) were vertical-transfer students. Characteristics of the analytic sample will be postponed to the section entitled “Different matching strategies,” where we discuss our matching strategies, where we discuss our matching strategies.

Table 2 presents transfer patterns among the 4,678 vertical-transfer students. The results show striking variation in students' transfer pathways. Traditionally, students are expected to earn approximately 60 community college credits prior to transfer, but very few students followed that traditional pattern in Virginia: Vertical-transfer students' accrued college-level credits ranged from 0 to 184 at the point of transfer, with a mean of 52

Table 2. Transfer patterns among vertical-transfer students ($N = 4,678$).

Outcome	%	<i>n</i>
College-level credits earned at point of transfer		
≤ 20	13	630
> 20 and ≤ 40	18	844
> 40 and ≤ 60	24	1,119
> 60	45	2,085
Timing of transfer		
1st academic year	2	77
2nd academic year	15	708
3rd academic year	27	1,273
4th academic year	23	1,062
5th academic year or beyond	33	1,558

credits and a large standard deviation of 24 credits. More importantly, almost one third of the transfer students transferred with 40 or fewer credits. These descriptive patterns support the concern, raised in a previous section, that restricting analytic samples based on a high pretransfer credit-accrual threshold (typically ranging from 48 to 60 credits in existing studies) would remove a substantial proportion of the vertical-transfer population from the analysis and thus limit the generalizability of the findings.

In a similar vein, we observed substantial variation across students in terms of the timing of transfer. Traditionally, students are expected to transfer at the beginning of their 3rd academic year; however, in our sample, more than 17% transferred in their 1st or 2nd year and more than one third transferred more than 5 years after initial college enrollment.

As noted previously, some studies have further restricted their sample of 4-year native students to those who attended nonselective or minimally selective 4-year institutions. Yet as shown in Table 3, 90% of the vertical-transfer students in our sample transferred to a 4-year institution categorized as either “selective” or “more selective” in the federal IPEDS database. As

Table 3. Institutional characteristics of 4-year colleges attended by vertical-transfer students versus those of native 4-year college students.

Institutional Characteristic	Transfer Students	Native 4-Year College Students
Selectivity		
Inclusive	10%	9%
Selective	73%	47%
More selective	17%	43%
SAT Critical Reading—25th percentile	484	510
SAT Critical Reading—75th percentile	586	609
SAT Math—25th percentile	485	509
SAT Math—75th percentile	582	608
Size		
Total headcount	21,842	17,488
Full-time equivalent (FTE) enrollment	15,973	14,080
Total expenses per FTE student	\$19,740	\$23,059

Note. Information on institutional characteristics was retrieved from the Integrated Postsecondary Education Data System 2005.

might be expected, native 4-year students are more likely than vertical-transfer students to attend more selective institutions. However, given the high proportion of vertical-transfer students who enrolled in a selective 4-year college, we were reluctant to drop selective attendees from either our 2-year or 4-year entrant samples. We will return to this topic in more detail in our discussion of propensity score matching.

Basic model

We considered two outcome measures to estimate whether transfer students who resembled native 4-year students at the time of transfer would achieve similar outcomes: (a) the probability of attaining a bachelor's degree, and (b) labor-market earnings in 2012. For bachelor's degree attainment, a naïve comparison would follow Equation 1:

$$\text{Probit}(BA_{attainment_i}) = \alpha + \beta T_{woyear_i} + X_i + \mu_i \quad (1)$$

The outcome measure was whether a student received a bachelor's degree from any college within 8 years of college entry. The key explanatory variable β was equal to 1 if a student entered the 4-year sector via community college, and X_i represents a vector of controls, shown in Table 4.

For labor-market earnings, a parallel equation would follow the classic Mincerian model shown in Equation 2:

$$Y_i = \alpha + \beta T_{woyear_i} + Exp_i + Exp_i^2 + X_i + \mu_i \quad (2)$$

where Y_i represents average quarterly earnings in 2012 for individual i . The effect of entry into the 4-year sector via community college was captured by β , X_i represents the same vector of controls used in Equation 1, and Exp_i represents the student's labor-market experience in 2012. Our estimate of labor-market experience included two components. First, using UI data, we

Table 4. Probability of entering the 4-year sector via the transfer route among eventual 4-year college attendees (probit model with marginal effects reported).

Variable	Coefficient (Marginal Effects)	Standard Error
Age at initial enrollment	.012***	.001
Age-squared term	.000***	.000
Female	-.001	.003
Black (base group: White students)	.019***	.004
Asian	.019***	.006
Hispanic	.071***	.008
Other Race/race unknown	-.098***	.007
Applied and eligible for financial aid	-.063***	.003
English as a Second Language student	.785***	.018
Quarters employed pre-entry	.036***	.001
Pseudo R-squared	.15	
Observations	42,788	

* $p < .1$. ** $p < .05$. *** $p < .01$.

calculated each individual's number of quarters of employment from 2004 to 2012 and divided it by 4 to obtain years of employment. Second, to estimate the number of years of employment prior to 2004, we followed the approach used by Liu, Belfield, and Trimble (2015) by subtracting 18 years and the number of quarters enrolled in college (converted to years first by dividing the total number of quarters by 4) from a student's age at the beginning of 2004. We also added a quadratic term of work experience to accommodate the possibility of nonlinear relationships between work experience and earnings (e.g., diminishing returns to work experience), as noted by Mincer (1974).

Different matching strategies

To understand how vertical-transfer students differed from native students in background characteristics at the point of entry into a 4-year college, we conducted a probit model predicting entry into the 4-year sector via community college (Table 4), together with accompanying descriptive statistics (shown in the "Unmatched" column of Table 5). These analyses indicated that among eventual 4-year attendees, 2-year colleges were more likely to be selected as an initial entry point by older students, Hispanic students

Table 5. Sample characteristics prior to initial college entry (prematch vs. postmatch).

Variable	Sample	Unmatched				Matched			
		Mean	Std. Dev.	Std. Diff.	S-Ratio	Mean	Std. Dev.	Std. Diff.	S-Ratio
Age	Transfer	20.10	5.09	0.40	1.83	20.01	5.01	0.01	1.03
	Native	18.10	2.78			20.01	4.85		
Age-squared term	Transfer	430.03	295.71	0.32	2.34	425.26	292.55	0.00	1.06
	Native	335.24	126.60			426.51	274.71		
Female	Transfer	0.55	0.50	0.01	1.00	0.55	0.50	0.01	1.00
	Native	0.56	0.50			0.56	0.50		
Black	Transfer	0.17	0.38	0.01	1.00	0.17	0.38	0.01	1.00
	Native	0.18	0.38			0.18	0.38		
Asian	Transfer	0.10	0.30	0.07	1.29	0.09	0.29	0.02	0.98
	Native	0.07	0.25			0.10	0.30		
Hispanic	Transfer	0.06	0.24	0.11	1.33	0.06	0.23	0.01	0.98
	Native	0.03	0.23			0.06	0.24		
Other race	Transfer	0.00	0.10	0.25	2.00	0.00	0.10	0.03	1.10
	Native	0.06	0.20			0.00	0.11		
English as a Second Language student	Transfer	0.06	0.23	0.25	17.95	0.05	0.21	0.03	1.08
	Native	0.00	0.01			0.04	0.19		
Applied and eligible for financial aid	Transfer	0.35	0.48	0.31	0.95	0.35	0.48	0.04	1.01
	Native	0.50	0.50			0.33	0.47		
Quarters employed pre-entry	Transfer	1.82	1.26	0.54	0.97	1.81	1.26	0.02	0.98
	Native	1.14	1.29			1.78	1.28		

Note. Std. Dev. = standard deviation; Std. Diff. = standardized difference in group means, calculated following the formula by Austin (2008). The S-ratio is the ratio of the standard deviation between the 2-year and 4-year samples, calculated by dividing the higher standard deviation by the standard deviation of the other group.

(compared to White students), English as a Second Language students, students who were ineligible for (or did not apply for) need-based financial aid, and students who were employed for more quarters prior to initial college entry.

Given the distinct differences in background characteristics between our samples of vertical-transfer students and native 4-year students, we used four different strategies to identify native 4-year students who were similar to vertical-transfer students, and we compared the results across strategies. Our first two strategies mimicked typical approaches in the literature (Long & Kurlaender, 2009; Monaghan & Attewell, 2015; Reynolds, 2012), while our third and fourth strategies were more novel.

Strategy 1 restricted the sample of vertical-transfer students and native students to those who earned at least 48 credits, and then it ran regressions on the restricted sample ($N = 35,873$).

Strategy 2 maintained the 48-credit restriction and used cross-institution propensity score matching to identify native students who were similar to each vertical-transfer student in terms of demographic characteristics observable prior to initial college entry (X_i) listed in Table 4. Specifically, for each student who eventually attended a 4-year institution and earned at least 48 credits, we estimated their propensity to enter the 4-year sector through the transfer route based on precollege demographic characteristics. We then used the estimated propensity scores to find the nearest matching native student for each transfer student with replacement, using the nearest-neighbor method within caliper 0.1 (Dehejia & Wahba, 2002). That is, transfer students who had no near match (within 0.1 standard deviation of the propensity score) in the native student group were dropped from analysis.

Figure 1 and Table 5 present the diagnostics of the matching results. Figure 1 shows the probability of being a vertical-transfer student for three groups: vertical-transfer students, native students in nonselective 4-year colleges, and native students in selective 4-year colleges. The majority of vertical-transfer students had a high probability of choosing the transfer pathway, while the majority of 4-year entrants had an extremely low probability. Yet contrary to the prevailing assumption in the literature, the probability distribution of nonselective 4-year college students was not markedly more similar to that of transfer students than was the probability distribution of selective 4-year college students; both were sharply skewed to the left. As a result, we kept both types of colleges in the sample to serve as a potential match for vertical-transfer students.

During the matching process, because the native 4-year college population was much larger than the vertical-transfer population, almost all vertical-transfer students were successfully matched within 0.1 standard deviations of the propensity score and only 1% of vertical-transfer students ($N = 57$) were

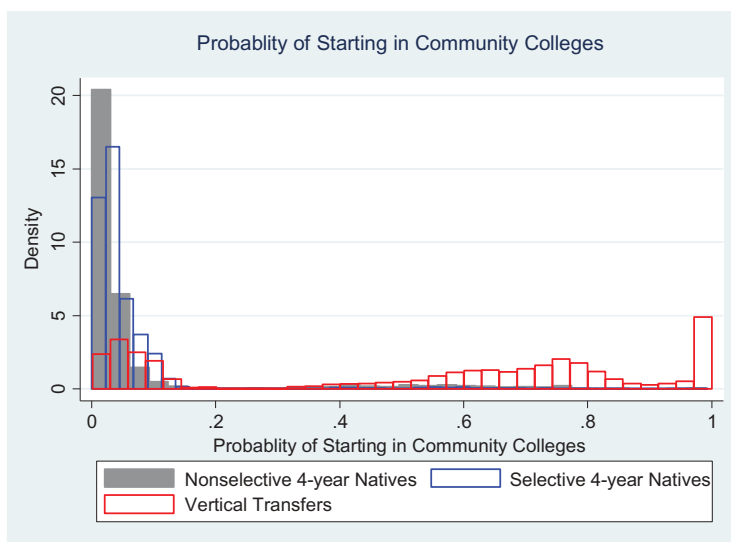


Figure 1. Distribution of probability of starting in community colleges for different groups of students.

discarded from the sample due to lack of support.² This led to a matched sample of 6,017 students.³

The “Matched” column of Table 5 shows the postmatch balance of covariates for Strategy 2. Following Austin (2008), we used the standardized difference (or SD, the absolute difference in sample means divided by an estimate of the pooled standard deviation of the variable, where 0 indicates perfect balance) to check balance in group means. Some researchers (e.g., Hill, 2008) have also recommended examining higher-order sample balance; therefore, we also checked the ratio of standard deviations between the 2-year entrants and the 4-year entrants (the S-ratio, where 1 indicates perfect balance). Overall, the matching process resulted in satisfactory balance, reducing most SD values to less than 0.10, with S-ratios hovering near 1. Figure 2 shows the probability densities for vertical-transfer students versus native 4-year college students after matching and demonstrates that the matching operations achieved satisfactory overlap between the two groups of students in terms of background characteristics.

Strategy 3 also used cross-institution propensity score matching to identify native 4-year college students who resembled transfer students in terms of the precollege demographic characteristics listed in Table 4. However, instead of imposing the 48-credit restriction, we used a stratified matching process, where students were matched on their accumulated college-level credits and prior GPA at the time of transfer, in addition to the propensity scores. For example, if a vertical-transfer student arrived in the 4-year college sector during fall 2006 (2 years after initial entry into the higher education system

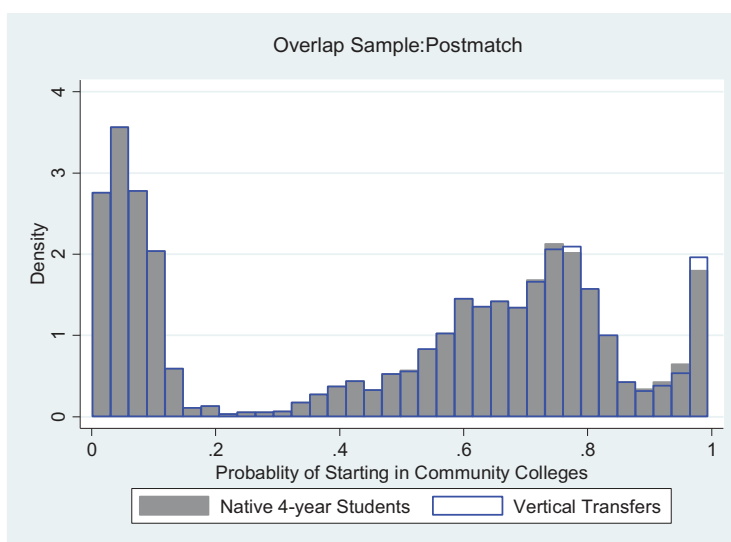


Figure 2. Distribution of probability of starting in community colleges after propensity score matching.

in Virginia) with 40 credits and a GPA of 3.0, under Strategy 3, he or she would be matched with a native 4-year college student who had also earned 40 credits at the beginning of fall 2006 with a GPA of 3.0 (also 2 years after initial entry) and who had not dropped out of the college by that term, regardless of the 4-year college that each attended. Due to the release of the credit restriction, Strategy 3's matched sample ($N = 6,695$) was much larger than that of Strategy 2 ($N = 6,017$), and it was more representative of the overall sample of vertical-transfer students.

Finally, to take into account that vertical-transfer students were less likely to enroll in more selective institutions, *Strategy 4* built on Strategy 3 but further extended it by conducting within-institution matching. Specifically, the matching process now involved four criteria: (a) The vertical-transfer student and the native 4-year college student were similar in pre-college-entry demographic characteristics as captured by their propensity scores; (b) the two students attended the same 4-year institution; (c) the two students had earned a similar number of college-level credits at the beginning of the term when the transfer student arrived at the 4-year institution (and the native 4-year college student had not dropped out of the college by that term); and (d) the two students were similar in their previous GPA at the time of transfer.

For example, if a vertical-transfer student A arrived in a 4-year institution X during fall 2006 (2 years after initial entry into the higher education system in Virginia) with 40 credits and a GPA of 3.0, under Strategy 4, she would be matched with a native 4-year college student at institution X who had also earned 40 credits at the beginning of fall 2006 (also 2 years after initial entry)

with a GPA of 3.0 and who had not dropped out of college by that time. As such, the two matched students would be identical in their previous academic performance and number of accumulated credits by the time of transfer; the only difference was that the transfer student earned those credits from community colleges, while the native 4-year college student earned the credits from the 4-year destination college.

Results

Vertical-transfer students versus native 4-year college students

Our aim was to examine whether the academic and labor-market outcomes of vertical-transfer students were different from similar native 4-year college students. To answer this question, we used Equations 1 and 2 to examine three outcomes (baccalaureate attainment, average quarterly earnings in 2012 unconditional on bachelor's degree attainment, and earnings conditional on bachelor's degree attainment)⁴ under the four separate sample construction strategies discussed in Section 3: (a) a 48-credit restriction with no matching; (b) a 48-credit restriction with across-institution matching on precollege demographic characteristics; (c) a stratified matching strategy using across-institution matching on precollege demographic characteristics, conditional on similar levels of credit accrual and GPA at the time of transfer; and (d) our preferred strategy, matching on precollege demographic characteristics, accumulated credits, previous GPA, and transfer destination. Table 6 shows the estimated impact of vertical transfer across each combination of the three outcomes and four sample construction strategies.

In terms of bachelor's degree attainment, the credit-restricted no-matching strategy (Strategy 1) and the traditional propensity score-matching strategy (Strategy 2) resulted in a statistically significant negative estimate, although matching students based on demographic characteristics substantially reduced the size of the effects. When we matched students within levels of credit attainment and previous GPA at the time of transfer (Strategy 3), transfer students had a significantly higher probability of completing a bachelor's degree. Yet, once we further matched students within each 4-year institution, the estimated difference in baccalaureate degree attainment between the two groups narrowed and was no longer significant.

In terms of labor-market outcomes, however, all four strategies yielded negative coefficients. Focusing on our preferred Strategy 4, the estimates suggested that vertical-transfer students, despite their comparable probability of baccalaureate attainment, had lower quarterly earnings 8 years after college entry (by \$891 per quarter or about \$300 per month); this earnings penalty was similarly large even among baccalaureate recipients.⁵

Table 6. Baccalaureate attainment and labor-market outcomes of transfer students versus native 4-year college students.

Matching Strategy and Outcome	Estimate	Standard Error	R ²	N
1: Without matching (48-credit restriction)				
Baccalaureate attainment	-.17***	.01	.06	35,873
Average quarterly earnings, 2012	—	136	.06	18,954
	\$2,531***			
Average quarterly earnings, 2012 (conditional on bachelor's degree attainment)	—	169	.05	15,414
	\$2,481***			
2: Propensity score matching across destination colleges (48-credit restriction)				
Baccalaureate attainment	-.02*	.01	.07	6,017
Average quarterly earnings, 2012	-\$664	520	.07	3,923
Average quarterly earnings, 2012 (conditional on bachelor's degree attainment)	-\$388	761	.06	2,473
3: Propensity score matching across destination colleges (matched on credits prior to transfer)				
Baccalaureate attainment	.04***	.01	.11	6,695
Average quarterly earnings, 2012	-\$411***	150	.10	4,595
Average quarterly earnings, 2012 (conditional on bachelor's degree attainment)	-\$898***	202	.11	2,917
4: Propensity score matching by destination college (matched on credits prior to transfer)				
Baccalaureate attainment	.02	.01	.13	6,530
Average quarterly earnings, 2012	-\$891***	150	.11	4,514
Average quarterly earnings, 2012 (conditional on bachelor's degree attainment)	-\$947***	195	.12	2,864

* $p < .1$. *** $p < .01$.

Exploring potential challenges for vertical-transfer students

Post-transfer academic shock

To explore whether vertical-transfer students experienced transfer shock upon arrival at the receiving institution, we matched transfer students and native 4-year college students using Strategy 4 (i.e., matching on demographic characteristics, accumulated credits, previous GPA, and transfer destination). Based on the matched sample ($n = 6,530$), we examined term-by-term fluctuations in number of credits attempted and GPA earned. The results are shown in Figure 3, with the regular downward spikes in attempted credits indicating summer terms. We centered time at the semester of transfer (or for the native 4-year college students, at the semester of their matched pair's transfer). The majority of students in the matched sample influenced the patterns across the 0 to +10 range, and all influenced the patterns near the 0 marker; but students who transferred earlier (and their matched 4-year college peers) heavily influenced the patterns in the range of +10 to +20. The figures revealed two interesting patterns.

First, although the two groups began with similar GPAs at the point of transfer due to our matching strategy, the typical transfer student experienced a decline in GPA immediately after arrival at the 4-year institution, by



Figure 3. Term-by-term fluctuations in credit load and grade point average (GPA) among vertical-transfer students and matched native college students in the 4-year institution.

approximately 0.3 points on the 4.0 scale (e.g., from B– to C+). However, the average vertical-transfer student’s GPA began to rebound the next semester and eventually rose back up to that of their matched native peers.

Second, both sets of students’ credit loads declined over time in large part due to the fact that full-time students began to complete college and left behind part-time students who carried lower credit loads. However, while native and transfer students’ credit loads were similar across the first 2 years after transfer, after that point, vertical-transfer students carried a consistently heavier load. This pattern may suggest that vertical-transfer students were working to overcome credit loss at the time of transfer or excess crediting requirements, a hypothesis that we further explore in the next section.

Loss of credits and delayed graduation

The results in Table 6 (based on our preferred Strategy 4) suggest that although vertical-transfer students were equally likely as matched native 4-year college students to earn a bachelor’s degree, they suffered from lower earnings 8 years after initial college enrollment. One potential explanation for these findings is that vertical-transfer students took longer to graduate, perhaps due to a loss of credits at time of transfer or excess crediting requirements. In turn, this longer time to graduation would have negatively

Table 7. Enrollment outcomes for vertical-transfer students versus native 4-year college students.

Outcome	2-Year Entrants	4-Year Entrants	Effect Size
All matched students			
Number of credits (any type)	123	103	20.35 (1.01)***
Number of college-level credits	118	102	15.78 (1.00)***
Number of semesters enrolled	14	11	2.61 (.12)***
Still enrolled at beginning of 2012	38%	32%	0.06 (.01)***
Number of postexit quarters	4	6	2.41 (.01)***
Baccalaureate earners			
Number of credits (any type)	139	121	18.14 (.85)***
Number of college-level credits	133	120	13.72 (.84)***
Number of semesters enrolled	15	12	2.41 (.13)***
Number of postexit quarters	4	5	1.22 (.02)***

Note. The sample was constructed using Strategy 4 (within-institution match including credits accumulated at the time of transfer).

*** $p < .01$.

influenced their short-term labor-market performance, given that the bulk of positive returns to bachelor's degrees are due not to immediate increases in earnings levels but to increases in earnings growth across several years after graduation (Jaggars & Xu, 2016).

While we could not directly observe loss of credits in the transcript data (as the data set did not indicate which community college credits were accepted by each 4-year college), Table 7 compares matched transfer and native 4-year college students within the same destination college (i.e., using Strategy 4) in terms of the total number of college-level credits they eventually earned. Vertical-transfer students earned 20 more credits than their matched 4-year college peers. This difference remained almost the same even among students who attained a bachelor's degree. As a result, vertical-transfer students earned 17 more credits than should be necessary for a traditional 4-year degree, suggesting either that they lost at least 17 credits at the point of transfer or that they were required to earn additional major-specific credits. It is not surprising, then, that 2-year entrants spent more semesters in college than their native 4-year counterparts and were more likely to still be enrolled at the beginning of 2012 (more than 7 years after their initial college enrollment).

Discussion and conclusion

Our results indicate that vertical-transfer students are indeed a “good bet” for 4-year admissions in that they had a comparable probability of baccalaureate attainment compared with native 4-year students with a similar background and academic record. This finding could be due, in part, to the fact that the transfer process represents a strong screening mechanism, such that only the strongest and most motivated students ever transfer to a 4-year school (Jenkins & Fink, 2016). Regardless, the finding may help reassure both 2-

and 4-year colleges that community college transfers who appear “on paper” to be academically similar to native 4-year college students are indeed equally likely to succeed in the 4-year college environment.

In contrast to their comparable baccalaureate attainment, vertical-transfer students in our study had lower earnings 8 years after college entry, and this labor-market penalty was robust and consistent across different model specification and matching strategies. This finding is worrisome from an equality perspective, as it suggests that even among transfer students who are equally likely to succeed academically in the 4-year institution, their early labor-market performance is negatively influenced by the transfer route to a baccalaureate degree. Subsequent analyses examining students’ term-by-term credit accrual and GPA provided several policy implications in terms of the vertical-transfer process and post-transfer support. We outline these findings and policy implications and then discuss implications for further research.

Implications for the transfer process

In our data set, we found that vertical-transfer students had typically earned more college credits at graduation, supporting the notion that they suffer from either credit loss at the time of transfer or excess crediting requirements. In addition, students’ highly varied transfer patterns accord with other recent research suggesting there is no “well-trodden” highly structured pathway for transfer students to follow; instead, students seemed to be left to discover their own idiosyncratic path to a 4-year institution (e.g., Bailey et al., 2015; Baker, 2016; Jaggars & Fletcher, 2014; Scott-Clayton, 2011). As states and colleges search for new strategies to increase transfer rates and the success of transfer students, our results suggest that the responsibility should not rest solely with community colleges. Wyner et al. (2016) identified a number of high-performing transfer partnerships—in which 4-year colleges accepted and graduated high volumes of vertical-transfer students from partner community colleges—and found it was vital for these community colleges and universities to work together to align their curricula at the program level. For example, partner institutions provided detailed transfer guides showing community college students exactly which courses to take for all their credits to transfer and to apply toward their desired major at the 4-year destination college.

Nationwide, many college systems are in the process of reforming their vertical-transfer partnerships. For example, California recently introduced the Associate Degrees for Transfer (ADTs), which are statewide, major-specific agreements between the California community colleges (CCCs) and California state universities (CSUs). The twin goals of the ADT policy are to increase the number of transfers to CSUs and to induce more students with a transfer intent to earn an associate degree by providing

students with a structured curriculum at the CCCs that prepares them for efficient transfer to the CSUs. Baker (2016) took advantage of the phased roll-out of the ADTs across colleges and departments throughout the state of California and used a triple difference-in-difference design to assess the causal impacts of ADTs on degree completion and transfer. Her findings showed that the ADT policy resulted in 35% more associate degree completions and a greater number of transfer students to the CSUs in the later years of the policy implementation.

Overall, our results suggest that 4-year colleges' vertical-transfer students will be more likely to graduate and enter the labor market on time if those institutions work with their key feeder community colleges to create more structured academic transfer pathways—particularly pathways in which students who earn a transfer-oriented associate degree in a given field are guaranteed junior-level standing in a matching major at the 4-year college. To maintain and honor these pathways, however, 4-year college faculty must be engaged in long-term relationships with their counterparts at key feeder community colleges (Bailey et al., 2015). Unfortunately, Wyner et al. (2016) noted that faculty at many 4-year research universities have clear disincentives to engage in outreach to and coordination with their community college counterparts, which makes it difficult to establish and maintain well-articulated academic transfer pathways.

Implications for post-transfer support

In our study, vertical-transfer students experienced a decline in GPA immediately after arrival at the 4-year institution. This pattern might be taken to imply that community college students' GPAs are inflated. However, the average vertical-transfer student's GPA began to rebound the next semester and eventually rose back up to that of their matched native peers, suggesting that community colleges appropriately prepared students for the academic rigor of the 4-year context. Accordingly, the temporary GPA dip may be partially due to transfer students' social and logistical adjustment to the new college environment. For example, students accustomed to small class sizes at their community colleges may initially be unsure how to connect with faculty and other students in the relatively large and impersonal context of many universities (Laanan, 2004; Owens, 2010; Townsend & Wilson, 2009). These findings highlight the critical role of the receiving 4-year institution to orient, advise, and provide support services to transfer students to facilitate their academic and social integration into the new educational setting.

Currently, 4-year colleges vary widely in terms of how well they support transfer students' success (Jenkins & Fink, 2016). In their study of 4-year colleges with strong transfer performance, Wyner et al. (2016) found that these institutions worked to dispel myths about the academic performance of

transfers on their campus, dedicated faculty and staff resources to improving transfer students' social and academic transition, and worked to ensure equitable financial aid policies for transfers. In addition, these 4-year colleges worked with community college partners to identify students interested in transfer early in their college career, to help them explore and choose programs (or at least broad fields) as quickly as possible, and to prepare these students for a smooth transition (Wyner et al., 2016).

Implications for future research

Our results suggest three implications for future researchers in this area. First, the majority of our vertical-transfer students attended a 4-year college defined as either selective or more selective according to IPEDS. As a result, previous studies restricting the sample to open-access or nonselective colleges may distort the representativeness of the transfer student population—at least in some states, such as Virginia. Yet we also found that vertical-transfer students were less likely than native 4-year college students to attend more-selective colleges. As a result, failure to control for institutional differences between vertical-transfer students and native 4-year college students would likely bias estimates in favor of native 4-year college students.

Second, while we matched students based on their cumulative college-level credits and GPA received from these courses by the term of transfer, our strategy did not take into account potential differences between transfer and native 4-year college students in their fields of study. For example, students exposed to the greater diversity within the community college population could develop a stronger interest in prosocial fields such as education or social work, which have lower labor-market returns than other popular fields such as business or engineering. Future studies with more detailed information on students' programs of study may wish to further improve the matching strategy by comparing between students within particular fields.

Third, the data set available to us followed students' earnings for only 8 years after initial college enrollment. Approximately 40% of the vertical-transfer students and 30% of the matched native 4-year college students were still enrolled in college at the end of our tracking period. Even among students who earned their baccalaureate degrees during the time period under study, most did so only a few years before the end of the study. Previous research on Virginia community college students suggested that the bulk of positive returns to bachelor's degrees are due not to immediate increases in earnings levels but to accelerations in students' earnings growth over time (Jaggars & Xu, 2016). Accordingly, future studies may wish to examine longer-term impacts of the community college pathway to the baccalaureate on students' labor-market performance.

Notes

1. National data were drawn from the 2009 Beginning Postsecondary Students Longitudinal Study (BPS). The BPS contains student-level data on a national representative sample of students who enrolled in college for the first time in 2003–2004 and were tracked to 2009.
2. Because some vertical-transfer students were dropped from the analytic sample due to lack of support, the means for the vertical-transfer students changed slightly between the unmatched and matched samples.
3. Because we used matching with replacement, some native 4-year college students were matched to multiple transfer students.
4. We also ran a separate analysis on earnings among students who did not receive a bachelor's degree, and the results were similar to those with baccalaureate earners.
5. We also conducted a robustness check by imputing lower salaries (25th percentile of earnings), average salaries, and higher salaries (75th percentile of earnings) for students who were missing earnings records in 2012. The patterns of results remained similar under the preferred matching strategy (Strategy 4).

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