Community College Transfer Student Success: Using a Cross-Classified Random Effects Model to Explore Individual, Community College, and University Effects

Paul D. Umbach
Jeremy B. Tuchmayer
Ashley B. Clayton

North Carolina State University
Department of Leadership, Policy, and Adult and Higher Education
300 Poe Hall, Campus Box 7801
Raleigh, NC 27695-7801
paul_umbach@ncsu.edu

The American community college functions as a gateway to higher education and serves as a vehicle for upward mobility, opportunity, and prosperity for millions of low-income, minority, and first-generation college students seeking entry to the American middle-class (American Association of Community Colleges [AACC], 2012; Glass & Harrington, 2002; Pew Charitable Trusts, 2012). Community colleges provide a critical pathway for students to transfer to a four-year college in pursuit of a baccalaureate degree.

While approximately 80 percent of all students who begin postsecondary study at a community college intend to complete a bachelor's degree, less than one-quarter are ultimately successful within six years (Bradburn, Hurst, & Peng, 2001; Bradburn & Hurst, 2001; USDE, 2010). Moreover, only between 23 and 27 percent of all community college students complete the associate's degree within three years (ACT, 2010). Researchers have explained this discrepancy by positing that community colleges dissuade students from their educational goals (Brint & Karabel, 1989) through a process of cooling-out (Clark, 1960) or the diversion effect. Others have argued that community colleges have a democratizing effect (Rouse, 1995) in that many students who matriculate at a community college would not have otherwise enrolled in postsecondary study.

The democratizing versus diversion debate has generated much discussion in the literature. Many studies have found a strong diversion effect, or a community college penalty, for students who begin postsecondary study at community colleges in terms of reduced educational attainment or degree completion (Alfonso, 2006; Bowen, Chingos, & McPherson, 2009; Doyle, 2009; Long & Kurlaender, 2009; Sandy, Gonzalez, & Hilmer, 2006).

While the function of community colleges varies widely, "in some states, such as North Carolina, the community college is decidedly oriented toward occupational training; the transfer function has been a fairly recent development" (Dougherty & Townsend, 2006, p. 9). As the mission of the community college system has become more focused on the transfer function, this study seeks to illuminate the turbulent pathway community college transfer students experience en route to the baccalaureate. While a plethora of studies have examined the influence of individual effects on community college transfer

student success, there is a relative dearth of research on what individual, community college, and university factors that enhance a student's academic success and persistence post transfer.

Purpose and Research Questions

The purpose of this study is to investigate the relationship between individual and institutional level characteristics at both the two-year and four-year institution and their association with community college transfer student success. Success in this study is defined as academic achievement, year-to-year persistence, and bachelor's degree attainment. Given that many students begin at a community college and transfer to a four-year university it is important to consider what factors are associated with post-transfer academic success and persistence. Therefore, the objective of this study is to examine individual and institutional factors associated with community college transfer student success at the sixteen public universities in North Carolina.

Addressing this gap in the literature, this study employs a cross-classified multilevel model to account for the clustered nature of the data and the impact that both the community college and four-year institution have on post transfer student success. Utilizing this methodological approach allows us to handle a complex nesting structure in which students are cross-classified in both the community college and four-year institution, something no other study has yet addressed. While many studies have examined student characteristics and transfer success using national longitudinal datasets, this study employs statewide panel data in order to examine the relationship that individual, community college, and four-year university characteristics have on post transfer student success in North Carolina. Therefore, this study asks four questions:

1. How much of the variance in our transfer student success measures lies between individuals, between community colleges, and between universities?

2. To what extent are individual pre-transfer measures (e.g., community college GPA, credits accumulated, associate's degree earned) and demographic characteristics (e.g., race/ethnicity, gender) associated with success at the university?

3. To what extent are characteristics of the community college (e.g., public university in the county, size) from which a student transfers associated with student success?

4. To what extent are structural characteristics of public universities (e.g., size, selectivity, Historically Black University) related to student success?

Literature Review

Community college students face a multitude of obstacles on the path towards baccalaureate degree attainment. Several studies have shown that academic ability, college-level preparation, or the differences in campus cultures, demographics and policies between the community college and four-year institution adversely affect transfer rates and baccalaureate degree attainment (Alfonso, 2006; Bailey & Weininger, 2002; Bradburn & Hurst, 2001; Dougherty, 1992; Dougherty & Kienzl, 2006; Hilmer, 1997; Leigh & Gill, 2003; Sandy, et al., 2006; Roksa, 2006; Shaw & London, 2001; Townsend, 1995; Wassmer, Moore, & Shulock, 2004). Others have found that low course-load intensity and credit accumulation reduce the likelihood that students are successful (Adelman, 1999, 2004, 2006; Doyle, 2011).

Disagreement exists in the literature as to the extent to which community college transfer students succeed academically at their four-year institution. Some scholars have found that transfer students do quite well in their new institutions despite being less prepared academically as community college freshmen (Best & Gehring, 1993; Diaz, 1992; Johnson-Benson, Geltner, & Steinberg, 2001). However, other studies indicate that community college transfer students are unprepared for the rigorous curriculum at the nation's colleges and universities (Beckenstein, 1992; Dougherty, 1992; National Center for Education Statistics, 2003; Townsend, 2001). In fact, transfer students often experience transfer shock, a decrease in grade point average between the last semester at their former institution and the end of the first or second semester at their new institution (Cejda, 1994, 1997; Cejda, Kaylor, & Rewey, 1998; Glass & Harrington, 2002; Hills, 1965; Rhine, Milligan, & Nelson, 2000).

Individual Level Effects

Several researchers have conducted studies that examined the effect of individual characteristics on transfer student success (Dougherty & Kienzl, 2006; Doyle, 2009, 2011; Goldrick-Rab, 2010; Goldrick-Rab & Pfeffer, 2009; Long & Kurlaender, 2009; Mourad & Hong, 2011). These studies examined how race, gender, socioeconomic status, parental education, and prior academic ability affect

transfer student success. However, a majority of these and other studies focus on how these background characteristics affect the likelihood of transfer to the four-year institution; very few studies examine how these individual characteristics also influence persistence or degree completion post transfer. In general, these studies indicate that minority students and women are less likely to transfer to and persist in the four-year environment.

Academic preparation and remediation. A student's prior academic ability is one of the strongest predictors of academic success, and is highly correlated with first year grade point averages (Kuh, Cruce, Shoup, Kinzie, & Gonyea; 2008; Mourad & Hong, 2011). Community college students with higher levels of academic preparation in high school are also more likely to transfer and complete a four-year degree. Academic preparation factors shown to have the greatest impact on community college students transfer success include stronger math proficiency (Hoachlander, Sikora, Horn, & Carroll; 2003), standardized test scores, high school GPA, motivation to succeed academically, and future educational expectations and aspirations (Porchea, Allen, Robbins, & Phelps, 2010). Community college transfer students with lower community college GPAs are less likely to persist and ultimately graduate from their four-year institution (Dennis, Calvillo, & Gonzalez, 2008).

Students whose prior preparation indicated deficiencies in one or more academic concentrations must often take remedial coursework, and remediated students face a multitude of difficulties that make them less likely to persist in college (Kinzie, Gonyea, Shoup, & Kuh, 2008). While some studies have shown that remediation has the ability to resolve math skill deficiency (Bahr, 2008), few remedial math students remediate successfully (Bahr, 2007). Moreover, regardless of performance in their first math course, students who experience disappointment in subsequent math courses are less likely to persist to the four-year degree (Bahr, 2009). Overall, community college students in remediation complete fewer credit hours, are less likely to persist to degree completion, and are less likely to transfer to a four-year institution (Bettinger & Long, 2005).

Associate degree and credit accumulation. Community college students who complete associate degrees or have greater credit accumulation are more likely to persist and eventually complete

their four-year degree. In one national study, researchers found that 43 percent of community college transfer students who earned their associate's degree also earned their bachelor's degree. This completion rate far outpaced the success experienced by transfer students who did not earn their associates degree, finding that only 17 percent of the students who transferred to a four-year institution without an associate's degree completed their bachelor's degree (McCormick, & Carroll, 1997).

In addition to associate's degree completion, credit accumulation is also positively associated with transfer student success. Students who indicate a desire to transfer to a four-year institution at the time of their matriculation to community college ultimately attempt more credit hours; successfully transfer more credit hours to their four-year institution, particularly in core subjects like math, English, and the sciences; maintain higher course loads post transfer; and are more likely to persist at their four-year institution (Bahr, 2010). Similarly, community college students who attempt and complete a higher number of credit hours in their first year are more likely to transfer and persist at the four-year institution (Adelman, 1999, 2004, 2006; Doyle, 2009, 2011). Another study also found that greater credit accumulation and higher community college GPAs positively influenced persistence and degree completion at the four-year institution; however, an inverse relationship existed between the length of enrollment (semester accumulation) at a community college and bachelor degree completion (Mourad & Hong, 2011).

Institutional Level Effects

When examining the effects of transferring from a community college to a four-year institution, it is important to consider how institutional level effects might impact the success of transfer students. While many studies have examined student level characteristic and behaviors; there is a considerably less focus on the nature of campus environments (Smart, Feldman, & Ethington, 2006). It is likely that both community college characteristics and university factors could have an effect on transfer student outcomes.

Community college. Community colleges are defined as "any institution regionally accredited to award the associate in arts or the associate in science as its highest degree" (Cohen & Brawer, 2003, p. 5).

While there are vast similarities across community colleges in regards to access and transfer mission, there are still varying institutional differences that may impact transfer success. Some of the more common factors that vary by institution include size, urbanicity, racial composition, multi-campus models, and proximity of four-year universities. For example, one study found differences in community college transfer rates according to the racial and ethnic composition of the student body (Wassmer et al., 2004). Another study found a negative relationship between community college size and the likelihood of transferring to a four-year institution (Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008).

Similarly, some research has focused on institutional level effects on student achievement at the community college. One related study used data from both the high schools and community colleges in North Carolina to examine institutional effects on whether a student transferred (Clotfelter, Ladd, Muschkin, & Vigdor, 2013). Community college level variables included in the model were multi-campus, proximity to a University of North Carolina four-year college, expenditures per full-time equivalent student (FTE), enrollment, proportion of students in curriculum courses, and the number of companies with customized training arrangements. The study found that the only institutional characteristic that was statistically significant was the presence of a nearby four-year public university, which had a negative effect on success rates at the community college (Clotfelter et al., 2013).

Four-year university. Varying university characteristics such as size, selectivity, expenditures per FTE, and demographic classification likely impact the success of transfer students. While not much research has examined four-year institutional effects on the academic success of transfer students, a few studies have examined the impact of four-year university characteristics on traditional student populations.

Several studies have examined institutional effects on student attrition (Titus, 2006b; Chen, 2012), as well as student persistence and retention rates (Gansemer-Topf & Schuh, 2006; Titus, 2004, 2006b; Webber & Ehrenberg, 2010). Numerous studies have also examined how institutional characteristics affect degree attainment at four-year institutions (Gansemer-Topf & Schuh, 2006; Kim, 2007; Kim, Rhoades, & Woodward, 2003; Oseguera, 2005; Ryan, 2004; Titus, 2006a; Webber &

Ehrenberg, 2010). Student persistence and graduation rates were found to be positively associated with institutional selectivity (Gansemer-Topf & Schuh, 2006; Kim, 2007; Oseguera, 2005; Titus, 2004; Titus, 2006a), size (Ryan, 2004; Titus, 2004) and private institutions (Oseguera, 2005; Ryan, 2004; Titus, 2006a).

Theoretical Framework

This study is guided by the theory of human capital accumulation. The human capital model suggests individuals invest in an assortment of knowledge, skills, and competencies in order to increase their productivity and earn higher wages (Becker, 1993). The rise in American high school graduates pursuing postsecondary education can increasingly be attributed to the belief that one accrues considerable economic benefits, as well as gains in health, nutrition, civic and cultural engagement, and overall quality of life as a direct result of one's investment in postsecondary education (Becker, 1993). Human capital theory assumes that education, job training, and other means of acquiring knowledge and skills are a form of capital investment that benefits both oneself and society. The human capital theory posits that, *ceteris paribus*, wage income is positively correlated with knowledge and ability. Thus, the labor market rewards individuals who invest in additional education or training with greater salaries. Human capital theory relies on the assumption that labor market outcomes are influenced by the level of one's productivity, and that variance in productivity is attributable to the different types of investment individuals make in themselves, as exemplified through both the quantity and quality of their education and job training skills, among other factors (Becker, 1993; Mincer, 1974).

Community colleges provide students with open access to postsecondary education and offer an affordable gateway for students from all economic backgrounds. The human capital model suggests a framework for why students might choose to begin postsecondary study at community colleges rather than four-year institutions. In an attempt to reduce the costs of a college education, some students may wish to first matriculate at community colleges because they are substantially less expensive than four-year institutions and can significantly reduce the overall cost of the baccalaureate degree. Moreover, community colleges may also provide marginal students an opportunity to better their educational record,

improving their odds of transferring to a more selective baccalaureate institution. Indeed, some have suggested transfer students who began postsecondary study at community colleges ultimately matriculated to higher quality universities than they otherwise would have attended had they not begun at a community college, with students from lower income families and those who performed poorly in high school making the largest gains (Hilmer, 1997).

Methodology

Data

Our data come from the state of North Carolina and include students who transferred to one of the University of North Carolina's 16 public four-year institutions after having completed at least 24 credit hours from one of the state's 58 community colleges. We analyze five cohorts of data from first-time transfers in the fall semester from 2006 to 2010. Our final sample includes 20,259 transfer students across the five cohorts.

Our dataset had several measures from student performance at the community college prior to transfer, including cumulative grade point average at the community college, credits earned at the community college, number of remedial subjects required (one, two or three; English, math, or reading), and whether the student earned an associate's degree prior to transfer. From the university system data, we obtained our race/ethnicity, age, and gender, along with our outcome variables, which include grade point average after each semester, persistence to following spring and fall semesters, and graduation for the 2006 and 2007 cohorts. In addition, we merged the student-level data with data from the Integrated Postsecondary Data System to obtain characteristics of community colleges (enrollment, size, multi-campus, urbanicity, and public university in county) and universities (acceptance rate/selectivity, enrollment, and Historically Black University). See Table 1 for a description of the variables included in our models.

We had no missing data for any of the variables included in the models. However, we did wish to include pre-college measures of ability (SAT/ACT and high school grade point average). Because both of these variables had more than 40% missing, we did not include them in our analyses. We did run separate

models on those students with both SAT and high school GPA and other models that included dummy-coded variables for the presence of values for each of these variables. Without exception, inclusion of these variables did not change the results of our models.

Analytical Approach

We use a cross-classified random effects model to explore the relationships between individual transfer student attributes, characteristics of community colleges from which these students transfer, and the four-year schools to which they transfer and student success. Handling this complex data structure presents a unique challenge not often addressed in the higher education literature.

Typically researchers have constructed ordinary least squares regression models attaching group level variables to individuals. Variables such as institution type have been attached to individual models of student success. Models using this strategy have four problems. First, they violate a fundamental assumption of regression by treating the observations as if they were independent of one another. The impact of being nested within a community college or university is overlooked in such models. Second, using these methods make it very difficult to partition what can be attributed to community college and university affiliation and what can be attributed to the individual. Third, these approaches can result in inaccurate parameter estimates or inappropriate degrees of freedom, thus leading to poor or even misleading policy analyses. Finally, they are limited in their ability to explore the interaction effects of community colleges, universities, and individuals.

For more than a decade higher education researchers have run models taking into account the nested organizational structures of higher education (Ethington, 1997; Porter & Umbach, 2001; Umbach, 2007). They employ multilevel modeling (MLM) techniques in an attempt to appropriately handle the complex organizational effects of colleges and universities and provide the tools necessary to arrive at results that are more accurate. Yet few, if any, studies of community college students have used MLM to examine community college transfer student success.

Employing MLM with our data is problematic because of the complicated nesting structure of community college transfer students. To use a standard MLM model that incorporates both institutions

and individuals, one would have to assume a hierarchical nesting structure where students are nested within community colleges, which are then nested within four-year institutions. However, students from one community college do not attend a single four-year college or university, breaking down the hierarchical nesting required of traditional multilevel models. Complex data structures like these, where individuals are cross-classified by two or more higher-level units, are typically modeled using a cross-classified random effects model (see Raudenbush & Bryk, 2002 for a full explanation). For example, cross-classified random effects models have been used to study the effects of neighborhoods and schools on educational attainment (Garner & Raudenbush, 1991), the educational attainment of students from two different types of schools (Goldstein, 1995), the influence of industry sector and city on earnings (Shu, 2005), and the contribution of reviewer and research attributes on grant proposal ratings (Marsh, Jaysinghe, & Bond, 2003).

Employing a cross-classified random effects model allows us to partition the variance in student success (GPA, persistence, degree attainment) into three parts: the student, the community college, and the university. Once partitioned, we are able to model individual, community college, and four-year institution relationships.

Dependent variables and the unconditional model. The first step is to determine the amount of variance explained by community colleges, universities, and individual transfer students. We use several dependent variables as measures of transfer student success at the universities in our data set, including grade point average after each semester, persistence to spring and following fall semester, and graduation (for only the 2006 and 2007 cohorts). In a cross-classified random effects approach, the first step is to create the null model with no predictor variables. The within cell model can be expressed as

$$Y_{ijk} = \pi_{0jk} + e_{ijk} \quad [1]$$

where Y_{ikj} , the dependent variable, is the outcome measure[1] for student *i*, in *j* college and university *k*. The π_{0jk} term is the mean outcome for a student in cell *ij* (*i.e.* student in *j* college and university *k)*. Finally, e_{ijk} is the random student effect, or the deviation of student *ijk*'s outcome from the cell mean. The within-cell model allows us to describe the variation among students within each cell of the cross-classification of community colleges and universities.

We also can assess the variation between cells that is attributable to community college and university effects:

$$\pi_{0jk} = \theta_0 + b_{00j} + c_{00k} + d_{0jk} \quad [2]$$

where θ_0 is the grand mean outcome of all transfer students in the data set; b_{00j} is the main effect of community college *j* across all universities, or the contribution of *j* universities averaged across all community colleges; c_{00k} is the main effect of university *k* across all community colleges, or the contribution of *k* university averaged across all community colleges; and d_{0jk} is the random interaction effect, or the deviation of the cell mean from the predicted grand mean and the two main effects.

By substituting equation [2] into equation [1] to create a single model

$$\ln Y_{pjk} = \theta_p + \beta_p X_k + \gamma_p W_j + b_{p0j} + c_{p0k} + d_{pjk} \quad [3]$$

which is analogous to a two-way analysis of variance with random row effects (community college), random column effects (university), two-way interaction, and within cell deviation. This model allows us to partition the variance in faculty salaries that can be attributed to community colleges, universities and individual transfer students.

Independent variables and the within cell model. We include several human capital and background variables at level-one (individual level) to understand individual characteristics associated with transfer student success:

[1] Note that for the categorical dependent measures (e.g., persistence, graduation), we ran logistic cross-classified random effects models.

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk} X_{ijk} + e_{ijk} \quad [4]$$

where, again, Y_{ikj} , the dependent variable, is the outcome measure for student *i*, in *j* college and university *k*. In addition, $\pi_{1jk} X_{ijk}$ is the vector of human capital and background variables. Finally, e_{ijk} is the random student effect, or the deviation of student *ijk*'s outcome from the cell mean.

Level-two or between-cell model. At level-two (community college and university), we test the effects of several structural variables. The first block includes a vector of community college (X_j) and university (W_k) variables as fixed effects in our level-two models. In this case, the level-two equation is expressed as

$$\ln Y_{pjk} = \theta_p + \beta_p X_k + \gamma_p W_j + b_{p0j} + c_{p0k} + d_{pjk} \quad [5]$$

Given the data requirements to run cross-classified random effects models, it is important to be parsimonious when specifying them. Likewise, it is often difficult to find structural measures that are not highly collinear. That said, we include several variables in our level-two models. Using Clotfelter's (2012) work on transfers to guide the building of our community college model, we included college size (enrollment), urbanicity, whether the college had a public university in its county, and whether the college had more than one campus. The university variables included those common to the study (*cf*. Titus, 2004, 2006) of characteristics associated with success: selectivity, size, and whether the institution was a Historically Black University.

Results

Null Model

As our research questions and analytical strategy description suggest, the first step in building a cross-classified random effects model is to partition the variance that can be attributed to community college affiliation, university affiliation, and individual students (see Table 2). A few things are worth noting. As expected, individual students explain most of the variance in our dependent measures. However, the variance explained by college and university affiliations are nontrivial, particularly as it relates to persistence and baccalaureate degree attainment. In terms of variance explained by community

college attendance, it ranges from 1.4% for end of the second year GPA to 6.6% for baccalaureate degree attainment for the 2006 cohort. In terms of grade point average, it seems the farther the students get from entry into the university, the less community college and university affiliation matter in explaining grades.

Full Model Results

Grade point average models. Our first set of models presents the results from our models of grade point average after each semester (see Table 3). First, we observe that the community college a student attends is related to, at least in some small part, their outcomes at the four-year institution. Across all four semesters studied here, higher grade point averages at the community college were associated with higher grade point averages at the four-year institution. Each one point increase in community college GPA translates to a .66 to .81 GPA increase at the university.

Credit hours accumulated at the community college is also positively associated with GPA at the university. For every credit earned, GPA at the four-year institution increases approximately .002 points. Similarly, those arriving at the university with an associate's degree have statistically significantly higher GPAs, at least in the first three semesters. In the first semester, those with an associate's degree have university GPAs that are .119 points higher. The difference drops to .038 points in semester two and .028 points in semester three. By semester four, the difference is not statistically significant.

In general, the more subjects of remedial courses required the lower the transfer student GPA. Those who take only one remedial course do not perform much differently than those who take none. However, those required to take three remedial subjects have average GPAs between .116 and .058 points lower than those who require no remediation.

We also observe some important differences in the relationship between student demographics and GPA. In general, age is positively associated with GPA at the university. Women, on average, have higher GPAs than men across all semesters, ranging between .068 and .087 points higher. Students of color, primarily Asian American and African American students, have lower GPAs than their white

transfer peers. African American GPAs range between .149 and .194 points lower than whites across the four semesters, and Asian American GPAs range between .106 and .162 points lower than whites.

In terms of community college attended, students who attend a community college that has a public university nearby have statistically significantly higher GPAs than other community college transfers. The difference is .137 points in the first semester, and it steadily decreases to .089 points in the fourth semester. Community college size, as measured by student enrollments, appears to matter early in transfer students' careers at the university. In the first semester, for every thousand student increase, GPA at the four-year institution, on average increases .01 points. The number drops to .009 points in the second semester and is insignificant in subsequent semesters.

We also observe some differences in transfer student performance between four-year institutions. Selectivity is negatively related with transfer student GPAs. With every percentage-point increase in selectivity, transfer student GPAs decrease, on average, .02 points in the first semester. The number drops to .001 points by the fourth semester. Size is only statistically significantly related to GPA in the first semester after transfer. After the first semester, the difference is no longer significant. Finally, students who transfer to one of the five HBCUs in the study perform better than those at PWIs. The average difference is .144 points in the first semester and drops to .099 points by the fourth semester.

Persistence and graduation. We then modeled persistence to the subsequent spring and following fall semesters along with baccalaureate degree attainment for those in the 2006 and 2007 transfer cohorts. Table 4 presents the odds ratios and standard errors for the four models. Our models again suggest that, in general, capital accumulated while at the community college enhances the likelihood of success at the university. For example, GPA at the community college is positively associated with persistence to the second and third semester and likelihood of earning a baccalaureate degree. Transfer students are 1.5 times as likely to persist to the following fall with a one-point increase in community college GPA. The relationship between community college GPA and baccalaureate degree attainment is even stronger. With a one-point increase in GPA, students are 1.9 to 2.3 times as likely to earn a baccalaureate degree.

Likewise, with every credit earned at the community college, transfers are 1.003 times as likely to persist to the following semester and following fall. Earning an associate's degree prior to transfer also significantly increases the odds of persisting to the spring and following fall semesters (1.09 times and 1.14 times, respectively). We see no relationship between having an associate's degree and baccalaureate degree attainment.

Finally, remediation is associated with persistence and degree attainment. For example, relative to taking no remedial courses, students who take one or two remedial subjects are more likely to persist to the fall semester (1.22 times more likely with two subjects; 1.33 times more likely with three subjects). However, we see no association between remediation and degree attainment.

Gender and race appear to matter less when predicting persistence and degree attainment. We see few racial and gender differences among transfers in the likelihood to persist and earn a degree. Women, however, are more likely than men to persist to the spring (1.26 times as likely), but they are 18 percentage points less likely to persist to the following fall semester.

In terms of persistence and institutional characteristics, we see some notable associations. For example, persistence is associated with whether or not a community college has a public four-year institution in the same county. Students attending these community colleges are 1.14 times more likely than those attending other colleges to persist to the spring semester. Relative to persistence and GPA, fewer institutional variables are significantly associated with degree attainment. The existence of a public university in the same county as a community college is positively associated with baccalaureate degree attainment (between 19 and 14 percentage points more likely). We also find that transfer students at HBCUs are 11 to 12 percentage points more likely than those at PWIs to earn a baccalaureate degree.

Discussion and Implications

This study offers some important and compelling insights into the relationship between transfer students, the community college they attended, the university to which they transfer, and educational outcomes. As college costs increase, many more look to community colleges as a way to reduce costs and provide a viable pathway to the baccalaureate. Yet we know surprisingly little about the pathways

from community colleges that are associated with success at four-year institutions. This study sought to fill some of these gaps by exploring the individual, community college and university factors that are associated with success and degree attainment.

Simply partitioning the variance in our student success measures between transfer students, community colleges, and universities is an important finding. While the variance attributed to community colleges and universities is somewhat small (between 1% and 7% for each level-2 component), it is nevertheless nontrivial and worthy of exploration. Nevertheless, it is important to note that an overwhelming percentage of what determines success is attributed to individuals.

We do, however, note some important institutional differences related to student success. It appears that having a public university near a community college is positively associated with student success. This runs counter to some research that suggests proximity to a public university is negatively associated with success at the community college (Clotfelter *et al*., 2012). However, it is important to consider the differences in outcomes. For example, Clotfelter (2012) used whether a student completed requirements for an associate's degree, which is less likely if a student has a nearby public university in which to transfer. However, in the case of those who transfer, it is quite likely that community colleges and universities in close proximity have strong relationships and mechanisms that ease the transition between the two institutions. It also is quite likely that students are familiar with the nearby four-year institution, making the transition to the new institution easier. Perhaps community colleges with no neighboring public university could work to build connections with nearby institutions in the state to develop policies that ease student transitions.

Size of the community college and university is also an important predictor of success, particularly early in the transfer student's experience at the four-year institution. Students coming from large community colleges earn higher grades in the first year and are more likely to persist to the second and third semesters. In contrast, size of the university is negatively related to first year grades and persistence to the second year. This may be helpful when we think about the transfer shock students experience when they arrive on the university campus. Coming from a large community college lessens

the shock of entering a large four-year institution, particularly early in the transfer student's experience at the university. Likewise, a large campus likely seems daunting to a new community college transfer. Four-year institutions may consider creating programs or incorporating transfers into existing programs that make their large campuses feel smaller to community college transfers.

Selectivity is also negatively related to many of our outcomes, suggesting that selective institutions may not be as transfer-friendly as less selective universities. These campuses are advised to examine support structures that enhance the likelihood of transfer student success and to explore the possible areas that may be causing challenges in transitioning transfer students.

Finally, transfer students in North Carolina appear to do quite well at the public Historically Black Universities in the state. In particular, students on these campuses earn higher grades, are more likely to persist to the second semester, and earn a baccalaureate degree. This signals that these campuses are doing something right for community college transfer students. Perhaps other campuses could learn from the HBCUs in the state.

When we examine our findings for transfer students, it appears that they are accumulating capital that is associated with a number of outcomes. Notably, remediation has a relatively complex relationship with the outcomes studied in this paper. While we find that remediation at the community college is negatively related with GPA, it appears to be positively related with persistence and has no relationship with baccalaureate degree attainment. Having enrolled in more than one remedial course and completed at least 24 credit hours at the community college and successfully transferred to a university, these students are, by definition, persisters, despite earning lower grades than students for whom remediation was unnecessary. This story runs counter to much of the previous research on remediation and the current policy conversation about the ineffectiveness of remedial coursework. What it does suggest is that students who make it through remedial courses and complete some college-level work prior to transferring can succeed. In the current policy climate, where states are directly or indirectly moving away from remedial course work in postsecondary education (*e.g.*, Florida, Connecticut, North Carolina),

these important college preparatory courses are in danger. States would be advised to consider these findings before moving forward with these plans.

It is no surprise that students accumulate important capital by earning good grades at the community college, accumulating credits prior to transferring, enrolling in a transfer program (Associate of Arts/Sciences), and earning an associate's degree. The positive relationship between capital accumulation and student success are in line with most research on transfer students. What may be important here is that we have partitioned the community college and university variance, and these associations remain. In other words, regardless of college and university attended, accumulating capital by being successful and earning substantial credits at the community college appears to lead to success at the university.

A cause for concern is the performance of student transfers of color. In particular, African American transfers appear to be less successful after transitioning to the university. Because these students are more likely to rely on community colleges as an inexpensive pathway to earn a baccalaureate degree, this may create important inequities that universities and policymakers may wish to consider.

This study has several limitations that may point to important areas of future research. First, it is important to note that we are not making any causal claims about our findings, and interpretations of our findings should be examined with this limitation in mind. In other words, we are not saying that earning an associate's degree causes students to perform better after they transfer, or attending a Historically Black University causes transfer students to perform better. However, given the relative dearth of research in this area, this study is an important first step in understanding factors associated with transfer student success. Future research may employ quasi-experimental approaches to attempt to reduce selection bias associated with the factors used in this study.

It also is important to note this study relies on administrative data provided by the North Carolina Community College System and the University of North Carolina General Administration. While the data offer a host of important variables, we are obviously missing variables that are associated with transfer student success. For example, other than GPA and persistence, we know little about student

experiences at the four-year institutions in the study. We also only have SAT/ACT scores and high school GPA for a small fraction of our transfers, as they were not stored by, or required for admission to, the community colleges, nor required for transfer admission to the universities. We also have no other pre-college measures such as parental education, family income, and other high school academic preparation factors that are likely important. Further, we know little about the courses students took at the community college. Future research could extend this study by looking at a range of these factors that research suggests affects student success.

Future research may look at programs that enhance transfer student success. Our findings suggested that there might be a benefit of having a community college and four-year institution nearby. Perhaps exploring possible relationships or programs these neighboring institutions have could prove useful.

References

ACT (2010). What works in student retention? Fourth national survey report for all colleges and universities. Retrieved from: http://www.act.org/research/policymakers/pdf/droptables/AllInstitutions.pdf.

Adelman, C. (1999). Answers in the tool box: Academic intensity, attendance patterns, and bachelor's degree attainment. *Technical report*. Washington, DC: United States Department of Education.

Adelman, C. (2004). Principal indicators of student academic histories in postsecondary education. *Technical report*. Washington, DC: United States Department of Education.

Adelman, C. (2006). The toolbox revisited: Paths to degree completion from high school through college. *Technical report*. Washington, DC: United States Department of Education.

Alfonso, M. (2006). The impact of community college attendance on baccalaureate attainment. *Research in Higher Education*, *47*, 873-903.

American Association of Community Colleges (2012). Reclaiming the American dream: Community colleges and the nation's future. Washington, D.C.: American Association of Community Colleges.

Bahr, P. R. (2007). Double jeopardy: Testing the effects of multiple basic skill deficiencies on successful remediation. *Research in Higher Education, 48*, 695-725.

Bahr, P. R. (2008). Does mathematics remediation work?: A comparative analysis of academic attainment among community college students. *Research in Higher Education, 49*, 420-450.

Bahr, P. R. (2009). Educational attainment as process: Using hierarchical discrete-time event history analysis to model rate of progress. *Research in Higher Education, 50*, 691-714.

Bahr, P. R. (2010). The bird's eye view of community colleges: A behavioral typology of first-time students based on cluster analytic classification. *Research in Higher Education, 51*(8),724-749.

Bailey, T., & Weininger, E. B. (2002). Performance, graduation, and transfer of immigrants and natives in City University of New York community colleges. *Educational Evaluation and Policy Analysis*, *24*(4), 359-377.

Beckenstein, L. (1992). Success rate of transfer students enrolled in a program for the underprepared at a senior college. *Journal of College Student Development*, *33*, 56-60.

Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis, with special reference to education*. Chicago: University of Chicago Press.

Best, G. A., & Gehring, D. D. (1993). The academic performance of community college transfer students at a major state university in Kentucky. *Community College Review*, *21*(2), 32-41.

Bettinger, E. P., & Long, B. T. (2005). Remediation at the community college: Student participation and outcomes. *New Directions for Community Colleges*, 2005: 17–26.

Bradburn, E. M., & Hurst, D. G. (2001). Community college transfer rates to 4-year institutions using alternative definitions of transfer. *Education Statistics Quarterly, 3*(3), 119-125.

Bradburn, E. M., Hurst, D. G., & Peng, S. (2001). Community college transfer rates to 4-year institutions using alternative definitions of transfer. U.S. Department of Education, National Center for Education Statistics. Available: http://nces.ed.gov/pubs2001/2001197.pdf

Brint, S., & Karabel, J. (1989). *The diverted dream*. Oxford: Oxford University Press.

Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton, NJ: Princeton University Press.

Calcagno, J. C., Bailey, T., Jenkins, D., Kienzl, G., & Leinbach, T. (2008). Community college student success: What institutional characteristics make a difference? *Economics of Education Review*, *27*(6), 632-645.

Cejda, B. D. (1994). Reducing transfer shock through faculty collaboration: A case study. *Community College Journal of Research and Practice, 18*, 189-199.

Cejda, B. D. (1997). An examination of transfer shock in academic disciplines. *Community College Journal of Research and Practice*, *21*(3), 279-288.

Cejda, B. D., Kaylor, A. J., & Rewey, K. L. (1998). Transfer shock in an academic discipline: The relationship between students' majors and their academic performance. *Community College Review, 26*(3), 1-13.

Chen, R. (2012). Institutional characteristics and college student dropout risks: A multilevel event history analysis. *Research in Higher Education*, *53*(5), 487-505.

Clark, B. A. (1960). The "cooling-out" function in higher education. *The American journal of Sociology, 65*(6), 569-576.

Clotfelter, C. T., Ladd, H. F., Muschkin, C. G., & Vigdor, J. L. (2013). Success in Community College: Do Institutions Differ? *Research in Higher Education*, 1-20.

Cohen, A. M.,& Brawer, F. B. (2003). *The American community college* (4th ed.). San Francisco: Jossey-Bass.

Dennis, J. M., Calvillo, E., & Gonzalez, A. (2008). The role of psychosocial variables in understanding the achievement and retention of transfer students at an ethnically diverse urban university. *Journal of College Student Development, 49*(6), 535-550.

Diaz, P. (1992). Effects of transfer on academic performance of community college students at the four-year institution. *Community/Junior College Quarterly*, *16*(3), 279-291.

Dougherty, K. J. (1992). Community colleges and baccalaureate attainment. *Journal of Higher Education, 63*(2), 188-214.

Dougherty, K. J., & Kienzl, G. S. (2006). It's not enough to get through the open door: Inequalities by social background in transfer from community colleges to four-year colleges. *Teachers College Record*, *108*(3), 452-487.

Dougherty, K. J., & Townsend, B. K. (2006). Community college missions: A theoretical and historical perspective. *New Directions for Community Colleges, 136*, 5-13.

Doyle, W. R. (2009). The effect of community college enrollment on bachelor's degree completion. *Economics of Education Review*, *28*, 199-206.

Doyle, W. R. (2011). Effect of increased academic momentum on transfer rates: An application of the generalized propensity score. *Economics of Education Review*, *30*, 191-200.

Gansemer-Topf, A., & Schuh, J. (2006). Institutional selectivity and institutional expenditures: Examining organizational factors that contribute to retention and graduation. *Research in Higher Education, 47*(6), 613–642.

Garner, C. L., & Raudenbush, S. (1991). Neighborhood Effects on Educational Attainment: A Multilevel Analysis. *Sociology of Education, 64*(4), 251-262.

Glass, J. C., & Harrington, A. (2002). Academic performance of community college transfer students and native students at a large state university. *Community College Journal of Research, 26*, 415-430.

Goldrick-Rab, S. (2006). Following their every move: How social class shapes postsecondary pathways. *Sociology of Education. 79*(1), 61–79.

Goldrick-Rab, S. 2010. Challenges and opportunities for improving community college student success. *Review of Educational Research, 80*, 437-469.

Goldrick-Rab, S., & Pfeffer, F. T. (2009). Beyond access: Explaining socioeconomic differences in college transfer. *Sociology of Education, 82*(2), 101---125.

Goldstein, H. (2010). *Multilevel statistical models (4 ed.)*. New York: Wiley.

Hilmer, M. J. (1997). Does community college attendance provide a strategic path to a higher quality education? *Economics of Education Review*, *16*(1), 59-68.

Hills, J. R. (1965). Transfer shock: The academic performance of the junior college transfer. *Journal of Experimental Education*, *33*, 201-215.

Hoachlander, G., Sikora, A. C., Horn, L., & Carroll, C. D. (2003). Community college students: Goals, academic preparation, and outcomes (NCES 2003-164). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Johnson-Benson, B., Geltner, P. B., & Steinberg, S. K. (2001). Transfer readiness: A case study of former Santa Monica college students. *New Directions for Community Colleges*, *114*, 77-85.

Kim, M. M., Rhoades, G., and Woodard, D. B. (2003). Sponsored research versus graduating students? Intervening variables and unanticipated findings in public research universities. *Research in Higher Education 44*(1): 51–81.

Kim, D. B. (2007). The effect of loans on students' degree attainment: Differences by student and institutional characteristics. *Harvard Educational Review, 77*(1), 64–100.

Kinzie, J., Gonyea, R., Shoup, R., & Kuh, G. (2008). Promoting persistence and success of underrepresented students: Lessons for teaching and learning. In J. Braxton (Ed.), *The role of the classroom in college student persistence* (pp. 21-38). San Francisco: Jossey-Bass.

Kuh, G.D., Cruce, T.M., Shoup, R., Kinzie, J. & Gonyea, R.M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *Journal of Higher Education, 79*(5), 540-563

Leigh, D. E., & Gill, A. M. (2003). Do community colleges really divert students from earning bachelor's degrees? *Economics of Education Review*, *22*(1), 23-30.

Long, B. T., & Kurlaender, M. (2009). Do community colleges provide a viable pathway to a baccalaureate degree? *Educational Evaluation and Policy Analysis, 31*(1), 30-53.

McCormick, A. C., & Carroll, C. D. (1997). Transfer behavior among beginning postsecondary students: 1989-94. Washington, DC: National Center for Education Statistics (ED 408-929). Retrieved from: http://nces.ed.gov/pubs97/97266.pdf

Marsh, H.W., Jayasinghe, U. W., & Bond, N.W. (2003). Improving the peer-review process for grant applications: Reliability, validity, bias, and generalizability. *American Psychologist, 63*(3), 160-168.

Mincer, J. (1974). *Schooling, Experience, and Earnings*. New York: National Bureau of Economic Research.

Mourad, R., & Hong, J. (2011). Factors Associated with Bachelor Degree Attainment by Community College Transfer Students. *The Journal of Applied Research in the Community College, 18*(2), 13-20.

National Center for Education Statistics. (2003). Postsecondary attainment, attendance, curriculum, and performance. Report prepared by C. Adelman, B. Daniel, I. Berkovits, & J. Owings. NCES 2003-294. Washington, D.C.: U.S. Department of Education, National Center for Education Statistics.

Oseguera, L. (2005). Four and six-year baccalaureate degree completion by institutional characteristics and racial/ethnic groups. *Journal of College Student Retention: Research, Theory and Practice*, *7*(1), 19-59.

Pew Charitable Trusts (2012). Pursuing the American dream: Economic mobility across generations. Washington, D.C.: The Pew Charitable Trusts.

Porchea, S. F., Allen, J., Robbins, S., & Phelps, R.P. (2010). Predictors of long-term enrollment and degree outcomes for community college students: Integrating academic, psychosocial, socio-demographic and situational factors. *The Journal of Higher Education, 81*(6), 750-778.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd). Thousand Oaks, CA: Sage.

Rhine, T. J., Milligan, D. M. & Nelson, L. R. (2000). Alleviating transfer shock: Creating an environment for more successful transfer students. *Community College Journal of Research & Practice*, *24*, 443-453.

Roksa, J. (2006). Does the vocational focus of community colleges hinder students' educational attainment? *Review of Higher Education*, *29*(4), 499-526.

Rouse, C. E. (1995). Democratization or diversion—the effect of community-colleges on educational-attainment. *Journal of Business and Economic Statistics*, *13*(2), 217-224.

Ryan, J. F. (2004). The relationship between institutional expenditures and degree attainment at baccalaureate colleges. *Research in Higher Education, 45*(2), 97–114.

Sandy, J., Gonzalez, A., & Hilmer, M. J. (2006). Alternative paths to college completion: Effect of attending a two-year school on the probability of completing a four-year degree. *Economics of Education Review*, *25*, 463-471.

Shaw, K. M., & London, H. B. (2001). Culture and ideology in keeping transfer commitment: Three community colleges. *Review of Higher Education*, *25*(1), 91-114.

Shu, X. (2005). Market Transition and Gender Segregation in Urban China. *Social Science Quarterly, 86*, 1299-1323.

Smart, J.C., Feldman, K.A., & Ethington, C.A. (2006). Holland's theory and patterns of college student success. In Commissioned report for the national symposium on postsecondary success: Spearheading a dialogue on student success. Washington, DC: The National Postsecondary Education Cooperative.

Townsend, B. K. (1995). Community-college transfer students—A case-study of survival. *Review of Higher Education*, *18*(2), 175-193.

Townsend, B. K. (2001, Fall). Redefining the community college transfer mission. *Community College Review*, *29*(2), 29-42.

Titus, M. A. (2004). An examination of the influence of institutional context on student persistence at 4-year colleges and universities: A multilevel approach. *Research in Higher Education, 45*(7), 673–699.

Titus, M. A. (2006a). Understanding college degree completion of students with low socioeconomic status: The influence of the institutional financial context. *Research in Higher Education, 47*(4), 371–398.

Titus, M. A. (2006b). Understanding the influence of the financial context of institutions on student persistence at four-year colleges and universities. *The Journal of Higher Education*, *77*(2), 353-375.

United States Department of Education (2010). *Digest of education statistics 2009*. Technical report, National Center for Education Statistics.

Wassmer, R., Moore, C., & Shulock, N. (2004). Effect of racial/ethnic composition on transfer rates in community colleges: Implications for policy and practice. *Research in Higher Education*, *45*(6), 651-672.

Webber, D. A. & Ehrenberg, R. (2009). Do expenditures other than instructional expenditures affect graduation and persistence rates in American higher education? Working Paper. Cornell Higher Education Research Institute (CHERI).