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Which Policies and Practices Influence Vertical Transfer and Baccalaureate Attainment among Community College Entrants? A Multi-level Analysis

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Which Policies and Practices Influence Vertical Transfer and Baccalaureate

Attainment among Community College Entrants? A Multi-level Analysis

by

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Dedication

To Lara

Acknowledgements

When I reflect on this journey, I am reminded of a quote from the Roman philosopher Seneca – "The time will come when diligent research over long periods will bring to light things which now lie hidden." Seneca could not have been more right. Beginning with the delay in getting the data, a pandemic that upended the whole world, and the complexity of the analysis, this was indeed research over a long period. Hopefully, I have also shed just a little light on what was hidden. I did not do this on my own, and I would like to acknowledge those who supported me along the way. First, I would like to express my gratitude to my committee – Dr. Schudde, Dr. Saenz, Dr. Giani, and Dr. Somers, for providing encouragement and valuable feedback.

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Abstract

Which Policies and Practices Influence Vertical Transfer and Baccalaureate Attainment among Community College Entrants? A Multi-level Analysis

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Community colleges serve many roles, but perhaps their most important is as a stepping-stone to a four-year institution. Unfortunately, over the past few decades, baccalaureate attainment for those beginning at a community college has declined. This waning has sparked an effort by legislators, community college leaders, and educational researchers to identify policies and practices to improve these outcomes. This study contributes to this by using a nationally representative sample of first-time college students to explore which factors at the student, institution, and state level are associated with vertical transfer and baccalaureate attainment. Results from a multi-level model illustrate that variables at all three analysis levels were significantly related to vertical transfer or baccalaureate attainment. At the student level, meeting with an academic advisor, staying continuously enrolled as a full-time student, working part-time or less, and choosing a transfer-oriented major were positively associated with vertical transfer or baccalaureate attainment, while transferring horizontally (to another institution at the same level) was negatively related to baccalaureate attainment. At the institution level,

the local unemployment rate was positively related and percent Pell recipients was negatively related to these outcomes. Cooperative agreements and statewide articulation guides were positively related to vertical transfer or baccalaureate attainment at the state level. The results offer insights that may be useful to higher education stakeholders and policymakers. I conclude with considerations for policy and practice, as well as for future research.

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Chapter One: Introduction

The potential for upward mobility is a cherished ideal and one that is central to the American ethos. One institution of American society that has served as a ladder for reaching this ideal is the community college, as it allows affordable and convenient access to education. For decades, community colleges have students with a myriad of educational goals, such as taking courses to prepare for the general education diploma (GED) exam, earning a two-year occupational degree, or pursuing adult basic or continuing education (Bauer, 1994; Kintzer, 1996; Knoell, 1966). However, their most important function may be as a steppingstone to a baccalaureate degree (Bragg, 2017; Cohen, Brawer, & Kisker, 2014; Handel, 2013; Mullin, 2012; Taylor & Jain, 2017). This role has become increasingly prominent as the employment market increasingly favors applicants with a four-year degree or higher (Carnevale, Smith, & Strohl, 2014). Perhaps not coincidentally, there has been a corresponding rise in the number of statewide policies designed to facilitate transfer from two-year institutions to four-year institutions to the point where most states have at least some sort of policy in place in 2020 (Francies & Anderson, 2020). At the beginning of the 2017, there were 1869 two-year institutions in the United States (U.S. Department of Education, 2019). Of these, 972 were public and not-for-profit community colleges. Of these public not-for-profit institutions, only 108 of these are found in large cities. Many of the rest are found in suburban and rural areas, giving a ring of truth to the name "community" college.

In addition to being conveniently located, community colleges are typically more affordable than four-year institutions. The average tuition and fees for two-year institutions during the 2018-19 academic year was $3,660. This cost is substantially lower than the average

of $10,230 for in-state tuition at public four-year institutions, or the $35,830 for private nonprofit four-year institutions (College Board, 2019). As two-year institutions are often located within the communities of students, there is also the potential for substantial savings in room and board as often there is no need to relocate or alter existing living arrangements. This combination of convenient location, open access, and affordable tuition allows the community college to serve as a gateway to higher education for those from backgrounds typically underserved by baccalaureate-granting institutions, including first-generation college students, and students from low-income families (Schudde & Goldrick-Rab, 2015). In a report summarizing the 2002 Educational Longitudinal Study, Lauff, Ingels, & Christopher (2014) found that of low-income students that attended college for the first time, 44% attended community college, compared to 15% of first-time students from high-income families.

As community colleges are two-year institutions, they typically offer associates degrees and other job-related training and certifications that can allow the student to obtain employment that pays a reasonable wage. As one example, the educational requirement for registered nurse in most jurisdictions is an associate degree (National Council of State Boards of Nursing, 2017) and the median annual wage for nurses in the United States in 2018 was $75,330 (U.S. Bureau of Labor Statistics, 2021). This is substantially higher than the median U.S. household income in 2020 of $68,400 and provides enough income to realize the proverbial "American Dream" – buying a house and starting a family.

Not all students who attend community college limit their aspirations to a two-year degree. Over four-fifths of community college students indicate they aspire to earn a bachelor's degree (Center for Community College Student Engagement, 2017). There are well-documented advantages to pursuing a four-year degree, including better employment opportunities and higher

expected earnings. Those with a baccalaureate degree earn approximately $300,000 more on average over a lifetime than those with only an associate degree. (Bureau of Labor Statistics, 2015; Hershbein & Kearney, 2014; Oreopoulos, & Petronijevic, 2013) and they are less likely to find themselves unemployed (Pew Research Center, 2014). There are advantages besides economic ones as higher degree attainment has been associated with better health and general well-being (Pascarella & Terenzini, 2005).

Despite concerns of degree saturation – having more college graduates than available jobs - this advantage has only increased over time (Bureau of Labor Statistics, 2015; Goldin & Katz, 2008; Pew Research Center, 2014). A report produced by the Georgetown University Center on Education revealed that the majority of jobs produced since the end of the Great Recession were managerial and professional jobs that required college degrees and about two-thirds of employers required a degree of some sort (Carnevale, Jayasundera, & Gulish, 2016). This trend is expected to continue as by 2022, approximately 80% of employers are expected to require some college level training (Richards & Terkanian, 2013). Low skill jobs like manufacturing, disappeared because of offshoring and automation, and never reappeared (Cocco, 2016). Of all the jobs created in the recovery, 8.4 million have gone to those with a bachelor's degree or higher, and 3.1 million went to those with an associate degree or some college. This is even true for nursing, where an increasing number of states and employers are requiring a bachelor of nursing degree (Gooch, 2015; Thew, 2018).

While the demand for a four-year degree has increased, public investment in higher education has steadily declined (Mitchell, Leachman, & Masterson, 2017). This has shifted the burden of financing higher education to students and their families. Combined with this shifting burden, the cost of education at traditional four-year programs has outpaced the rate of inflation

by at least 3.1% every decade since 1988 (CollegeBoard, 2018). In order to cover these increasing costs, students have borrowed more than ever. In 2017, student loan debt exceeded $1.5 trillion dollars (Board of Governors of the Federal Reserve System, 2018). For these reasons, and more, the community college has become an increasingly attractive option for those who aspire to earn a baccalaureate.

Under the backdrop, policymakers have strived to implement policies that would enhance the likelihood of transfer for those students who aspire to it, but to date, the literature does not provide a clear direction on which policy path to take. As one example, while several states have spent tens of millions implementing articulation and transfer policies, research that has explored the effectiveness of these policies have yielded discouraging results (LaSota & Zumeta, 2016; Roksa & Keith, 2008; Shapiro et al., 2017; Stange, 2012). Additionally, over the past few decades, the gap in baccalaureate attainment between comparable students that start at two-year institutions and four-year institutions has grown from less than 20 percentage points in the early 1970s to approximately 30 percentage points for the cohort beginning in 2004 (Schudde & Brown, 2019).

Statement of Problem

The United States is shifting towards a knowledge-based economy that places a higher premium on those with baccalaureate degree. Given this trend, community colleges face the challenge of putting in place policies and procedures that will enhance the likelihood of vertical transfer. Lamentably, the research to date does not provide a clear path for policymakers to improve vertical transfer and bachelor's degree attainment among community college entrants. As such, there is an unquestionable demand for additional research on the potential effectiveness

of certain policies intended to enhance vertical transfer and bachelor's degree attainment through a community college pathway.

Purpose of Study

The objective of this study is to contribute to the literature by identifying factors at the student, institution, and state level that influence vertical transfer, with particular attention paid to those factors that are of interest to policymakers.

Research Questions

I examine 6 interrelated research questions to examine the role of individual-, institutional-, and state-level factors in predicting two college outcomes, vertical transfer and bachelor's degree attainment:

1. To what extent do student-level variables influence vertical transfer among public two-year college entrants?

2. To what extent do institution-level variables predict vertical transfer among public two-year college entrants?

3. To what extent do state-level variables predict vertical transfer among public two-year college entrants?

4. To what extent do student-level variables influence baccalaureate attainment among public two-year college entrants?

5. To what extent do institution-level variables predict baccalaureate attainment among public two-year college entrants?

6. To what extent do state-level variables predict baccalaureate attainment among public two-year college entrants?

Significance of the Study

It is increasingly necessary to obtain a baccalaureate degree to earn a living wage in America. Community colleges and state governments can best serve the broader community by instituting policies and practices that enhance the likelihood of vertical transfer and degree attainment. As there is little consensus on the mechanisms influencing vertical transfer, more research into the topic is warranted. This study intends to shed additional light on what is effective and what is not in order to best guide institutions and state governments in putting policies and procedures in place to facilitate the vertical transfer of community college students.

Brief Overview of Methodology

The data used in this analysis was the Beginning Postsecondary Students (2012-2017) study. The BPS:12/17 is a nationally representative survey, collected by the National Center for Educational Statistics (National Center for Educational Statistics, 2014), that follows a cohort of first-time, beginning postsecondary students at three time-points: during their first year, at the three-year mark since entry, and at six years after beginning their postsecondary career (Bryan, Cooney, & Elliot, 2019). The BPS:12/17 draws its cohorts from the National Postsecondary Student Aid Study (NPSAS), which examines how students pay for their education. The NPSAS is a complex cross-sectional survey with a two-stage sampling design. The NCES sampled institutions first, then randomly selected students from the institution's enrollment list. I also linked the data to additional data sources, including from other NCES sources, the Bureau of Labor Statistics, and the Education Commission of the States, to incorporate additional institution- and state-level measures to the analyses.

To address my research questions, I use multilevel logistic regression (Raudenbush & Bryk, 2002) with random effects at the institution level and state level. The approach addresses

the fact that the data are hierarchically structured or nested—that individual observations are not independent—because students are nested in institutions, which are nested in states that may have different institutional transfer policies (Stevens, 2007). Because both of the outcome variables—vertical transfer and bachelor's degree attainment—were binary (transfer vs. not transfer, receives a degree or not), I used a logit link of the response for the outcome variables.

Delimitations

The study did not look at any outcomes besides vertical transfer and baccalaureate attainment.

The study did not include variables that originate from the national/federal level.

The study ass limited to students who are entering postsecondary education for the first time as community college students that were not enrolled in a community college baccalaureate program.

Definition of Terms

Baccalaureate attainment refers to a student obtaining a Bachelor's degree (B.A. or B.S.) from a four-year institution.

Beginning Postsecondary Student (2012-2017) longitudinal study is the most recent cohort of the BPS, collected by NCES. These students began their postsecondary education in 2012. NCES followed up in 2014 and 2017 to track students' educational experiences and outcomes.

Community college student is an individual that enrolls at a public two-year institution of higher education after high school.

Marginal Effect is sometimes referred to as a risk difference and refers to the difference in the predicted probability of success between two groups.

Multilevel logistic regression is a special case of the hierarchical generalized linear model that can be applied when the outcome is binary (Raudenbush & Bryk, 2002). It is an extension of ordinary least squares regression that accounts for hierarchically clustered data (e.g., students clustered in schools, schools clustered in districts).

NPSAS refers to the National Postsecondary Student Aid Study, the broader nationally representative sample of postsecondary students from which the BPS is a subsample. Its primary purpose is to determine how students pay for their post-secondary education.

SES is an abbreviation for socioeconomic status. It is often measured in terms of the income and education of the parents of the student and is positively related to a myriad of academic outcomes.

Transfer student is a student who initially enrolls at one postsecondary institution and then subsequently transfers their enrollment or earned credits to another institution while pursuing a degree (Shapiro et al., 2013).

Vertical transfer sometimes referred to as upward transfer means and refers to transfer from a two-year institution to a four-year institution.

Assumptions.

Assumption 1: The trend in job placement favoring those with four-year degrees is expected to continue.

Assumption 2: Improving vertical transfer and bachelor's degree attainment rates is a desired policy outcome.

Assumption 3: Policies can be implemented at the institution and state level that will enhance vertical transfer and bachelor's degree attainment.

Assumption 4: Empirical research can identify which policies may best meet this objective.

Summary

I began by describing the role of community colleges in society, particularly as a steppingstone towards a four-year degree, then offered a problem statement and a set of research questions focused on identifying predictors of two important outcomes: vertical transfer and bachelor's degree attainment. I described a strategy to identify state-, institution-, and student-level variables related to vertical transfer and bachelor's degree attainment using the 2011-2017 Beginning Postsecondary Survey and other data sources. In the subsequent chapter, I review the literature on factors that influence the vertical transfer of community college students.

Chapter Two: Literature Review

This chapter begins with a brief overview of the history of the community college from its inception to modern-day. This overview is followed up by a description of the transfer process and the institutional barriers that may hinder it. The chapter ends with a discussion of variables at the student, institution, and state level that influence vertical transfer.

A Brief History of the Community College

Beginning with the first standalone two-year institution – Joliet College in Joliet, Illinois – and continuing through most of the early twentieth century, two-year institutions emphasized transfer to four-year institutions (Brint & Karabel, 1991; Townsend, 2001). In the early 20th century, two-year schools primarily offered liberal arts courses that would be of similar scope and comprehensiveness of those offered at four-year institutions (Cohen, Brawer, & Kisker, 2014). This trend slowly started to shift in the 1960s with the passage of the 1963 Vocational Education Act, which significantly increased the number of federal funds allocated to community colleges for vocational training (Cohen, Brawer, & Kisker, 2014). During the 1970-71 academic school year, approximately 43% of degrees conferred were in diverse and vital occupations like nursing, auto repair, and information technology (Cohen, 2013). After peaking in the early 1980s at about 71%, the percentage of occupational degrees conferred slowly receded until the mid-1990s, where it stabilized between 55% and 60% and remained there into the 2010s.

This focus on vocationalization worked well for decades as during most of that time as an associate degree or certificate from a community college provided enough education to secure a job that paid a living wage. However, this is starting to change. A report produced by the Georgetown University Center on Education revealed that the majority of jobs created since the end of the Great Recession were managerial and professional jobs that required baccalaureate

degrees (Carnevale, Jayasundera, & Gulish, 2016). Millions of low skill jobs like manufacturing were permanently lost to automation and offshoring (Cocco, 2016). Of all the jobs created in the recovery, 8.4 million have gone to those with a bachelor's degree or higher, 3.1 million went to those with an associate degree or some college, and only about 80,000 new jobs were created for those with only a high school diploma. This trend is expected to continue as 65% of all jobs are expected to require some sort of postsecondary education in 2020 (Carnevale, Smith, & Strohl, 2014).

As the demand for a four-year degree has increased, so has the cost of education at traditional four-year programs, which has outpaced the rate of inflation over the past 30 years (CollegeBoard, 2018). To put it in perspective, there has been a focus on the rising cost of healthcare in recent years (Orsag & Ellis, 2007; Toader, 2014). Between 1980 and 2010, the growth of college tuition and fees was 596% above the core rate of inflation, while in that same time frame, medical costs increased "only" 241% (CollegeBoard, 2018). This confluence of events makes the community college a much more appealing path for cost-conscious baccalaureate aspirants as price increases in this sector were much more modest in comparison.

In this sense, the community college is what Rouse (1995) referred to as *democratizing* postsecondary education. Through their low cost and open access policies, community colleges provide opportunity for higher education for those who otherwise may not have attended college. On the flip side, there is the potential for community colleges to be *diversionary*, where they may attract students who otherwise would have attended a four-year institution and may thwart their pursuit of a bachelor's degree (Brint & Karabel, 1991; Rouse, 1995). Students who begin at a four-year institution are much more likely to earn a baccalaureate than similar students who begin at a community college (Alba & Lavin, 1981; Alfonso, 2006; Melguizo and Dowd, 2009;

Reynolds, 2012; Schudde & Brown, 2019). Thus, community colleges have been portrayed as an area where inequality is "simultaneously ameliorated by increasing educational opportunity and exacerbated by failing to improve equity in college completion across key demographics, such as race and socioeconomic status" (Schudde & Goldrick-Rab, 2016, p. 28). Inefficiencies in the transfer process may contribute to the diversionary effects of community colleges, where additional research can offer insights on how to best intervene to improve transfer.

The Transfer Process

It is not unusual for modern college students to transfer between institutions. An analysis of a nationally representative sample of students that first enrolled in 2003 found that approximately one-third transfer between institutions or co-enroll at least once within six years of initial enrollment (U.S. Department of Education, 2017). Of those who transferred, approximately one-in-four transferred more than once (Hossler et al., 2012). Taylor (2016) provided a detailed typology of transfer pathways. One example is a lateral transfer, where a student transfers from one two-year institution to another two-year institution. Another example is a reverse transfer is where a student transfers from a four-year institution to a two-year institution. A reverse credit transfer is where credits are transferred from a four-year institution to a two-year institution to award an associate degree, and dual-credit enrollment is where college-level courses taken in high school that transfer to a post-secondary institution.

While there are several possible ways a student can transfer, the popular conception of transfer at community colleges focuses on the vertical, or upward, transfer pathway (Katsinas et al., 2019; Taylor and Jain, 2017). A number of community college scholars have identified vertical transfer as the primary mission of the community college (Bragg, 2017; Cohen, Brawer, & Kisker, 2014; Handel, 2013; Mullin, 2012; Taylor & Jain, 2017). Transferring to a four-year

institution and ultimately earning a baccalaureate at some point is a stated goal of an estimated 81 percent of students that begin at two-year institutions (Xu, Jaggars, & Fletcher, 2016).

Despite these intentions of loftier academic attainment, fewer than 15% of community college students ultimately go on to earn a baccalaureate (Schudde & Goldrick-Rab, 2016; Jenkins & Fink, 2016). This attainment level is considerably lower than for students who start at four-year institutions (Alba & Lavin, 1981; Alfonso, 2006; Melguizo and Dowd, 2009; Reynolds, 2012; Schudde & Brown, 2019). This gap exists after controlling for student background variables (Brand, Pfeffer, & Goldrick-Rab, 2014; Breneman & Nelson, 1981; Doyle, 2009; Long, & Kurlaender, 2009; Monaghan & Attewell, 2015; Wang, 2015) and has been steadily increasing over time (Schudde & Brown, 2019). These findings suggest that the difference in attainment is not due entirely to differences in the students, but there are also institutional factors at play.

Institutional and Policy Barriers

To identify these institutional factors, Dougherty (1994) noted that in addition to coming from communities underserved in higher education, community college students also received significantly less financial aid. According to data from the National Postsecondary Student Aid Study (NPSAS) for 2012, this difference in aid persists today as only 57% of community college students received any financial aid, compared to 69% for students at non-doctoral granting institutions and 77% for students at public doctoral granting (Radwin et al., 2013). In addition to fewer community college students receiving aid, the amounts are considerably less. The average award for community college students was $4700, compared to $8800 for students at non-doctoral public four-year institutions, and $12400 for students at doctoral-granting institutions

(Radwin et al., 2013). However, it is unclear if these differences reflect differences in need as the cost for attendance at a community college is typically lower.

A second institutional factor identified by Dougherty (1994) was community colleges' weak encouragement of transfer. Dougherty attributes this to a byproduct of its contradictory goals of being a doorway to a baccalaureate degree and a "vending machine" for vocational training. The heavy focus on vocational programs necessarily diverts available resources away from preparing students for baccalaureate programs and vice-versa.

A third institutional factor identified by Dougherty (1994) is that community colleges are less able than four-year institutions to integrate students into the academic and social fabric of the institution. Tinto (1975, 1987, 1993) introduced a theory on student departure that posits that while institutions of higher education resemble small societies unto themselves, that are bilateral in nature, consisting of distinct academic and social aspects. The academic aspect concerns itself with the formal education of students. It focuses on the classroom and involves faculty and staff whose main objective is to educate the students. The social component focuses on the non-academic life of students at the institution. The theory posits that integration into the academic and social spheres of the institution leads to increased commitment to the institution. As this commitment increases, the likelihood of departure decreases.

In addition to aspects of the two-year institution serving as an unintended barrier to baccalaureate attainment, some have speculated that it may be a goal of the institution itself. One older notion was Burton Clark's (1960, 1980) "Cooling Out Theory" theory that asserts a primary function of community colleges is to dissuade students whose academic ambitions exceed their abilities from pursuing a four-year degree. This theory draws from a process by where an individual who has been the victim of a con game is eased out of the idea of being a "sure

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winner" by a game master, into that of a "victim" (Goffman, 1952). Applying this process to community colleges, Clarke (1960) described cooling out as a students' gradual disengagement from loftier academic goals in favor of avenues of lesser academic achievement.

The "Cooling Out Theory" is widely cited in the literature (e.g., Bahr, 2008; Broton, 2019; Hellmich, 1993) and contributes to what Brint and Karabel (1989) described as the diversionary effect of community colleges – shunting students away from pursuing a four-year degree and into a vocational program or associate degree program. While the theory may have held merit in decades past, recent research does not support it. Two longitudinal studies found that while some students do indeed "cool out," an even higher number "heated up" their aspirations increased while enrolled in a community college (Alexander, Bozick, and Entwisle, 2008; Leigh and Gill, 2003).

It is not only the community college environment that serves as a barrier to baccalaureate attainment but the transfer process itself. Monaghan and Atwell (2015) partitioned the trajectories of baccalaureate aspiring community college students into three phases: the initial two-year period; the process of transfer from a two-year to a four-year institution, and the post-transfer period. They found that there was little difference between students at two-year and four-year institutions on academic progress during the initial phase among those who did not attrit. Meaningful differences did not start to emerge until the Spring of the third year where a divergence appeared in retention, credits earned, and credits attempted. There are several reasons for this. Of those who did transfer to a four-year institution, many of the credits obtained at the community college did not transfer with them, resulting in a more arduous path to graduation. However, while it may take them somewhat longer due to credit loss, once community college

students transferred, they were approximately as likely as comparable native students to earn a baccalaureate (Monaghan and Atwell, 2015; Schudde and Brown, 2019).

Variables that Predict Vertical Transfer and Baccalaureate Attainment

Several factors influence vertical transfer and baccalaureate attainment, and they operate at multiple levels of analysis. First, there are aspects of the student, be it their background, academic preparation, or experiences they have in college. Second, there are institutional factors that may influence this relationship, be it the instructional expenses, the ratio of faculty to students or local economic conditions. Finally, there are potential state-level variables that include specific policies related to transfer and articulation. The following section will explore the literature regarding these factors at each respective level of analysis.

Student-level Factors

This section explores the role characteristics of community college students play in vertical transfer and baccalaureate attainment. Following this is a review of the literature on the relationship between the choices students make while in college on subsequent transfer. These variables are included because they provide controls to measure institutional and state variables more accurately. Additionally, some of these student-level variables could be affected by state or school policy or characteristics of the institution.

Background variables

Community college students are more likely than students who start at four-year institutions to be older, come from low socioeconomic status backgrounds, or be first-generation students, all of which are associated with a lower likelihood of vertical transfer and baccalaureate attainment (Dougherty and Kienzl, 2006; Gross and Goldhaber, 2009; LaSota & Zumeta, 2016). Community college also serve a disproportionate number of Black and Hispanic students when

compared to four-year institutions (Smith Morris, 2013). In this subsection, I review the extant research linking students' background to transfer outcomes.

Socioeconomic status (SES) is one of the most extensively researched constructs in education. It is frequently measured as a combination of education, occupation, and income (Saegert et al., 2007). Research consistently shows that family SES is positively correlated with academic performance (Alexander, Entwisle, & Bedinger, 1994; Caldas, & Bankston, 1999; Chan et al., 2000; O'Brien, Martinez-Pons, & Kopala, 1999; Sutton, & Soderstrom, 1999; Watkins, 1997). Two comprehensive meta-analyses have shown it to have a moderate to strong relationship with academic achievement (Sirin, 2005; White, 1982). SES has also been shown to be related to vertical transfer (Bowen, Chingos, & McPherson, 2009; Gross & Goldhaber, 2009; Jenkins & Fink, 2017; Lasota & Zumeta, 2016).   In addition to having more access to resources which can help with education, students from high SES backgrounds may be more likely to persist as paying for tuition may not be the barrier it is for others.

Some scholars have argued that the steady increase in the unadjusted cost of attendance, or "sticker price" has created a perception of unaffordability as one cause of college non-completion (St. John et al., 2000). A response to this is that several federal and state programs have focused on increasing need-based aid, which may will not affect the sticker price, but will lower the net price of attendance, or the amount students and their families are expected to pay. Between the 2007-2008 and 2017-2018 academic years, the number of Pell recipients expanded from 5.5 million in 2007-2008 to a peak of over nine million in 2011. It then declined to about seven million students in 2017-2018 (CollegeBoard, 2018). This decline has been attributed to the elimination of the year-round or summer Pell grant, and not due to a shift in the number of grants awarded (Fain, 2012)   In addition to expansion of the Pell Grant program, states have

increased the amount of need-based aid between 2006 and 2016 by 53% compared to an increase

of only 22% for non-need-based aid during that same period (Lederman, 2018)

As noted, community college students are more likely to be from communities

underserved in higher education. As such, they may have less access to information about the

cost of college and sources of financial aid (Feeney & Heroff, 2013; Horn, Chen, & Chapman,

2003; McKinney & Novak, 2013). In the 2007-2008 academic year, only 42 percent of

community college students that were eligible for a Federal Pell Grant filed the Free Application

for Federal Aid (FAFSA) (Kantrowitz, 2009). Those who failed to fill out a FAFSA were more

likely to leave college before the spring semester of their first year (McKinney & Novak, 2013).

Lack of financial aid may result in additional financial burden and taking on external obligations,

like working more hours for pay, or potentially stopping out (taking time off from enrollment),

which can significantly hinder the likelihood of degree completion (College Board, 2010).

The specific relationship between financial aid (once it is awarded) and vertical transfer

remains unclear. Turk and Chen (2017) found that students who received Pell Grants were 30%

less likely than non-Pell recipients to transfer. This result may be a bit misleading as the authors

did not otherwise control for SES, and as such, Pell recipient status likely served as a proxy for

SES (as Pell grant status is correlated with SES). So, in this instance, Pell Grant status is

actually serving as a measure of SES, which is known to correlate with academic outcomes. St.

John et al. (1994) also identified a negative relationship between financial aid and persistence.

Other analyses suggested that this result is more likely due to financial aid being insufficient as

opposed to ineffective. Using a difference-in-difference approach, Bettinger (2015) found that a

more generous Ohio state financial aid policy implemented in the Fall of 2006 resulted in a slight

decrease in the dropout rate and an increase in the likelihood students would choose a four-year

institution as opposed to a two-year institution. Using data from the U.S. Census, Dynarski (2003) found that the presence of large state merit programs were related to increased degree completion rates. Nguyen, Kramer. & Evans (2019) found that grant aid increases the probability of degree completion between two and three percentage points.

Findings on the relationship between race or ethnicity and vertical transfer over the years have been mixed. Research using data from the 1970s through the 1990s found that when no variables are controlled for, Black and Hispanic students tend to vertically transfer at rates similar to or lower than White students (Dougherty & Kienzl, 2016; Lee & Frank, 1990; Velez & Javalgi,1987). However, this relationship changes somewhat when including statistical controls. Using the 1972 Educational Longitudinal Study, Velez & Javalgi (1987) found that after controlling for other variables, identifying as Black was associated with a 13 percentage point increase in the probability of transfer compared with identifying as White. Identifying as Hispanic was associated with an increase in the probability of 18 percentage points compared to identifying as White. More recently, Dougherty and Kienzl (2016) explored racial/ethnic variation in two samples of data for students that attended college in the early 1990s – the Beginning Postsecondary Study of 1990 (BPS:90/96). and the National Educational Longitudinal Study of 1988 (NELS88). When no variables were controlled for, they did not find significant differences in transfer rates between Asian, Black, Hispanic, and White students in either the BPS:09/06 sample or the NELS88 sample. However, when other variables were controlled for, they found mixed results when comparing Black students to White students (the reference group). In the BPS:90/96 sample, White students were significantly more likely to transfer after controlling all other analysis variables. In the NELS88 sample, they found the opposite – after

controlling for all other variables, Black students were more likely to vertically transfer than White students.

Finally, high school academic performance predicts success in college (Cohn, Cohn, & Balch, 2004; Feldman, 1993; Shewach, McNeal, Kuncel, & Sackett, 2019l; Reynolds, 2012; Stumpf & Stanley, 2002; Wang & Wickersham, 2014). This was not just limited to high school. Academic performance in the first year of college was also related to both vertical transfer (LaSota & Zumeta, 2016) and baccalaureate attainment (Johnson & King, 2017; Wang & Wickersham, 2014).

College experiences

Background characteristics are not the only individual-level factors that may influence the likelihood of vertical transfer and bachelor's degree attainment among community college entrants. Events that happen at the community college may influence transfer as well. One of these events is time-of-entry. Presumably, students who are motivated to participate in higher education and have the resources are more likely to enroll in the fall semester after graduating from high school, or possibly even sooner. Those that are unsure of their ambitions, or lack the financial resources, are more likely to delay entry. As such, delayed entry students that attend a community college may be less likely to transfer to a four-year institution. There is some evidence to support this. Turk and Chen (2017) found that students who enrolled delayed community college enrollment more than three months were 43% less likely to transfer to a four-year institution than students who enrolled immediately after graduating from high school.

In addition to enrolling in a timely fashion, the enrollment intensity, or the course-load a student undertakes in any given term is another factor. In any given term, students can be enrolled full-time, part-time, or not enrolled. Research on enrollment intensity indicates that

students enrolled full-time are more likely to vertically transfer than students enrolled part-time (Adelman, 2006; Dougherty and Kienzl, 2006; LaSota and Zumeta, 2016; Turk and Chen, 2017).

One reason community college students are less likely to be enrolled full-time is because they are more likely to work while in college. Over half of community college students work, compared to about 37 percent of four-year students (Goldrick-Rab, 2010). The relationship between working while a student is somewhat complicated. Working on-campus and less than 20 hours a week is positively related to academic outcomes (LaSota & Zumeta, 2016). However, this type of arrangement is more prevalent at four-year institutions. Community college students are more likely have work arrangements shown to be negatively related to academic performance, such as working more than 15-20 a week (Dundes & Marx, 2006; Orszag, Orszag, & Whitmore, 2001; Pike, Juh, & Massa-McKinley, 2008), or working off-campus as opposed to on-campus (Kuh et al., 2007).

Additionally, about 37 percent of community college students transfer horizontally to another community college (Hossler et al., 2012). This can potentially hinder progress as credits may be lost in the transfer. Stopping out, or leaving the institution for a semester or more and then returning presumably has an adverse effect on vertical transfer and attainment, but to date, there is little to no research examining this.

Perhaps one of the most significant decisions a student can make is the choice of major. An academic major is the subject area to which a student formally commits before enrolling at an institution, or within the first two years. There are thousands of individual majors, and that number has been steadily growing. Since 2012, colleges and universities have added thousands of new majors since 2012 (Marcus, 2018). While the number of individual majors has exploded, they still fall into a handful of broad categories. At the community college level, these have

become known as meta-majors or career clusters, which refer to broad families of major programs that are common to one another (Bailey, Jaggars, & Jenkins, 2015). Community colleges have increasingly adopt meta-majors in eight areas of study: Arts, business; communication and design; humanities, education; health sciences; industry/manufacturing and construction public safety, science, technology, engineering, and mathematics; and social and behavioral sciences and human services. These meta-majors vary slightly across states, but there is a great deal of overlap.

Recent research has found that just declaring a major was linked to an increased likelihood of transfer (Turk and Chen, 2017). The type of major has also been shown to be related to the likelihood of transfer. Dougherty and Kienzl (2006) noted similar probabilities of upward transfer for STEM, humanities, social science, education, and humanities majors when compared to vocational students. LaSota and Zumeta (2016) found that undeclared students and business students had similar probabilities of transfer as vocational students.   In addition to declaring a major, having baccalaureate aspirations has been shown to be strongly related to vertical transfer (Dougherty and Kienzl, 2006; LaSota & Zumeta, 2016).

Once students have chosen a major, how engaged they are in their studies and life at the institution is critical to success. Student engagement is a construct related to earlier work on student departure, like Tinto's Theory of Student Departure (1975, 1993) and Astin's (1984) "Student Involvement Theory." The term "Engagement" loosely refers to the extent that students are engaged academically, behaviorally, and cognitively with their coursework and with their institution (Fredericks, Blumenfeld, & Paris, 2004; Jimerson, Campos, & Greif, 2003). Engagement behaviors can include social and academic contact with faculty or advisors,

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participation in study groups and clubs, speaking with faculty about academic matters (Pascarella & Terenzini, 1991).

The engagement of students is related to multiple positive academic outcomes, including GPA (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008) and persistence (Hughes & Pace, 2003). Using data from a national survey of community college students, researchers found a link between the number of visits with an advisor and student engagement (Center for Community College Student Engagement, 2018). Schudde (2019) found that first-year engagement experiences, including social and academic contact with faculty, was positively related to achievement, persistence, degree attainment, and vertical transfer.

Institution-level Factors

Community colleges serve varied purposes (Dougherty, 1994), including offering more academic programming that emphasizes vertical transfer to four-year institutions and more vocationally-oriented programming that emphasizes earning a job-related certificate or associate degree. Community colleges exist all over the country and in a variety of localities. Most are in urban or suburban settings, but there are several in rural locations as well. Students at rural schools may suffer as the schools tend not to have the financial resources of suburban and urban schools, and it can be difficult to recruit instructors to remote locations. Despite this, recent research has shown little difference in the vertical transfer rate based on urbanicity (Shapiro et al., 2017).

Institution-level socioeconomic status is often measured as the aggregate of the SES ratings for students. It may function independently from student-level SES as institutions with many students from high-SES families often reside in wealthier communities and as such, have more resources available to assist with education. In at least one analysis, college-level SES was

found to be positively related to vertical transfer (Shapiro et al., 2017). In many states, community colleges, unlike public four-year institutions, receive funding based on the locality they serve. As one example, in 2015, local appropriations exceeded state appropriations for community colleges in Kansas (State Higher Education Executive Officers Commission, 2020a). As such, the wealth of residents is likely associated with levels of funding.

Institutional resources can be used to maintain a fairly low faculty to student ratio. There is little research that explores the effect of these variables on vertical transfer. In an analysis using NELS 1988-2000 data, Gross and Goldhaber (2009) identified an inverse relationship between the student to faculty ratio and probability to transfer. In addition to all faculty, Gross and Goldhaber identified a positive relationship between tenured faculty and the probability of vertical transfer.

Instructional expenditures per student, which is tied to costs associated with the number of faculty and size of classes, may also serve as a proxy for educational quality. To date, there has been a fair amount of research into the relationship between expenditures per student and student performance. Among secondary students, Cullen et al. (2015) found instructional expenditures were positively related to state mandated assessments. Using data from the 2004 administration of the National Survey of Student Engagement, Pike et al. (2011) reported a positive relationship between expenditures and self-reported learning outcomes and passing rates among college students. Other researchers identified no relationship between instructional expenditures and the probability of vertical transfer (LaSota & Zumeta, 2016; Stange, 2012).

Historically, individual states financed the costs of public higher education. However, the percentage of per-student funding derived from state appropriations has steadily declined since the 1980s (Webber, 2018). This decline has not been steady across states, but uneven,

creating disparities in state funding levels between states. As state funding decreases, institutions necessarily rely more on tuition to make up the difference. As such, they may be more likely to expend resources on attracting students to attend (e.g., climbing walls, lazy rivers laser tag) rather than on academic programs. To date, there is no research, to my knowledge, that has explored whether these different levels of state funding influence vertical transfer of community college students.

In addition to factors internal to the institution, factors of the environment surrounding the institution may play a role. One of these factors is local economic conditions. If employment low and jobs are plentiful, it may lead to students leaving school to take a job, and when jobs are scarce, students may be motivated to stay enrolled. As one example, there was a 33 percent increase in attendance at two-year institutions between 2006 (one year before the Great Recession) and 2011 (U.S. Census Bureau, 2018). This relationship may be moderated by the availability of unemployment insurance, which may facilitate the acquisition of skills in the absence of employment (Barr & Turner, 2015). A relationship between local unemployment rate and community college enrollment has been observed (Hillman & Orians, 2013; Johnson, 2015). Johnson (2015) estimated that for every one-percentage-point change in the unemployment rate a community college can expect a 2.5-percentage-point change in the fall enrollment either up or down.

A few studies explore the relationship between local employment conditions and vertical transfer. Kienzl, Wesaw, & Kumar (2011) identified a negative relationship between local employment conditions and vertical transfer. However, LaSota and Zumeta (2016) did not identify any relationship. So, while there is an established relationship between the

unemployment rate and college attendance, there is still no clear relationship between the

unemployment rate and vertical transfer.

State-level Factors

The most studied state level variables related to vertical transfer or baccalaureate attainment are

related to statewide articulation and transfer policies.

Articulation and transfer policy

Several states have put in place policies to promote vertical transfer in order to smooth

the transition from community college to a four-year institution. Some examples of these policies

include statewide transfer agreements, cooperative agreements, articulation guides, common

course numbering, and general curriculum across two and four-year institutions (Education

Commission of the States, 2019). There has been a rapid growth in these sorts of policies in the

past few decades. In 1960, while there were individual institutions with agreements, no state had

an articulation or transfer agreement for public institutions (Keith & Roksa, 2008). However, in

2019, thirty states had policies mandating the transferability of lower-division courses or

guaranteeing the transferability of an associate degree and thirty-nine states had reverse transfer

policies that were either set in legislation, were board policy, or were through institutional

agreements, or other statewide programs. (Education Commission of States, 2019).

This growth has been fueled by a number of factors. First, every credit hour that does not

transfer adds a burden of time and money on the student and can contribute to discouraging

students from continuing their education or excess credit accrual (Fink, Jenkins, Kopko, & Ran,

2018). Variation in predictors of credit loss across states suggest that state policies and contexts

may be important predictors of students' transfer outcomes (Giani, 2019). Although states and

institutions have spent millions implementing and maintaining transfer and articulation

agreements, the extant research on the effectiveness of these policies suggests there is little effect on vertical transfer (Anderson, Sun, & Alfonso, 2006; Brawer, 1995; Roksa and Keith, 2008; LaSota and Zumeta, 2016). One study did identify a positive relationship for the presence of a broad statewide articulation and transfer policies (Stern, 2016). One possible reason for this is Stern used Anderson, Sun, and Alfonso's (2006) categorization of the policies, which Roksa (2009) described as being the more restrictive when compared to other inventories of statewide articulation policies.

There are some reasons why these findings are not as robust as hoped. First, the majority of these studies only looked at the presence of articulation and transfer policy in the broad sense, yet the policies can vary greatly in what policies are instituted and the degree to which they are instituted. As an example, one state may set up a common-course numbering system with a common core set of courses, while another state may set up a system to track and report vertical transfer data. Despite being very different policies with potentially different effects, they all fall under the umbrella of "statewide articulation and transfer agreements." This has led to a change in how the Education Commission of the States tracks articulation and policy. They no longer have a category for "statewide articulation and transfer policy," but instead track specific policies (Franceis & Anderson, 2020).

From the early 2000s to the mid-2010s, ECS tracked seven state-level variables: statewide policy; cooperative agreements; transfer data reporting; incentives and rewards; statewide articulation guide; common core of courses; and common course numbering. In recent years, they have streamlined the variables they track from these seven to five, dropping: statewide policy, cooperative agreements, transfer data reporting, incentives and rewards, and statewide articulation guide, while adding guaranteed transfer of an associate degree and reverse

transfer. While these changes may reflect what is important to legislators and educators, it may create challenges in building on the work of previous authors as the same variables may no longer be available.

This change in focus has appeared in recent research on the subject. LaSota and Zumeta (2016) examined specific aspects of transfer and articulation policy as tracked by ECS and found in their overall analysis that the presence of a statewide articulation guide was positively associated with vertical transfer. Additionally, when they subset by first generation, they found that common-course numbering was positively related to vertical transfer.

Summary

Through its open access and affordable cost, community colleges have long served as a democratizing vehicle for social mobility, particularly for those from less affluent backgrounds who otherwise might not attend college. An ineffective transfer system, in which community college entrants cannot efficiently transfer from a public two-year college to a four-year college, poses a substantial threat to the democratizing mission of community colleges. Given the increased value placed on a baccalaureate degree, policymakers for community colleges and state agencies must create an environment that facilitates, rather than impedes, vertical transfer for community college students interested in pursuing a bachelor's degree.

There is considerable research identifying student-level variables that are related to vertical transfer. However, what is of greater interest to policymakers are institutional and state-level factors that they have greater control over. To date, the research on the efficacy of these types of variables is mostly discouraging. This is particularly true for articulation and transfer policy – an area where substantial state and institutional resources are expended. The majority of

the empirical research to date indicates that implementation of transfer and articulation policy has no measurable effect on vertical transfer.

However, this is not the end of the story. Statewide transfer and articulation policies have expanded rapidly in the past few decades, which the majority of empirical research does not capture. Additionally, there may have been methodological challenges that occluded observation of an effect in prior research. New measures of state policies, collected by the Education Commission of the States, may allow for uncovering new information. As such, the effectiveness of articulation and transfer policy remains an unanswered question, and more high-quality research into the topic is warranted. In this dissertation, I use the most recent nationally-representative data, combined with the newest, most up-to-date measures of state transfer policies, to examine predictors of vertical transfer and bachelor's degree attainment among community college entrants.

Chapter Three: Methodology

Community colleges have long been an affordable and accessible path for completing the first two years of college. However, despite the increased value of a bachelor's degree in the marketplace, the baccalaureate attainment rate for community college students has steadily decreased since the 1970s, coinciding with the expansion of higher education (Schudde & Brown, 2019). The value of this study lies in identifying factors at the student, college, and state level that may provide insight into how to improve rates of community college transfer and baccalaureate attainment. To accomplish this, I used multi-level modeling to address the following research questions:

The present chapter describes the research design, data, and methodology used to answer the following research questions:

1. To what extent do student-level variables influence vertical transfer among public two-year college entrants?

2. To what extent do institution-level variables predict vertical transfer among public two-year college entrants?

3. To what extent do state-level variables predict vertical transfer among public two-year college entrants?

4. To what extent do student-level variables influence baccalaureate attainment among public two-year college entrants?

5. To what extent do institution-level variables predict baccalaureate attainment among public two-year college entrants?

6. To what extent do state-level variables predict baccalaureate attainment among public two-year college entrants?

Given my interest in the role of individual, institution, and state-level measures, I will rely on multilevel logistic regression, which is a special case of the hierarchical generalized linear model (Raudenbush & Bryk, 2002). This multilevel approach is appropriate because the outcome variables are binary, and the data are nested, where students are nested within schools that are nested within states.

Specific Design and Rationale

The specific quantitative approach is ex-post facto, or after-the-fact, non-equivalent groups design. It is a classification of research design where the investigation happens after the data are collected and without interference from the researcher. The secondary nature of the data and the lack of random assignment to conditions dramatically limits the ability to draw causal inference from any analysis of these data. However, using observational data is useful for an exploratory project like this dissertation, in which I seek to examine the role different variables at different levels play in predicting college outcomes. The detailed nature of the nationally representative data I use lends itself to building a multilevel model, especially because I am able to link to data at the institution and state level, in addition to the rich measures captured at the individual level.

Data Sources

The primary data source is the 2012-2017 administration of the Beginning Postsecondary Students Longitudinal Study (BPS:12/17). The BPS:12/17 is a nationally representative survey that follows a cohort of first-time, beginning postsecondary students at three time-points: during their first year, at the three-year mark since entry, and at six years after beginning their postsecondary career (Bryan, Cooney, & Elliot, 2019). The BPS:12/17 draws its cohorts from the National Postsecondary Student Aid Study (NPSAS), which examines how students pay for their

education. The NPSAS is a complex cross-sectional survey with a two-stage sampling design. The NCES sampled institutions first, then randomly selected students from the institution's enrollment list.

Use of BPS:12/17 data is restricted to license holders due to confidentiality concerns. Our research group obtained a license to use BPS:12/17 data, and I signed and returned the requisite confidentiality agreements to NCES to gain permission to access the data. BPS:12/17 data are stored on a standalone computer with no internet access in a secure room that only BPS:12/17 license holders may enter. I received additional approval from the University of Texas Institutional Review Board to conduct this study as an exempt project because the data are secondary and de-identified.

The BPS: 12/17 includes an exhaustive list of variables covering a myriad of topics. To select variables for inclusion, I first relied on a literature review to identify variables known to be related vertical transfer or baccalaureate attainment and then selected variables from the BPS: 12/17 that most closely matched the variables identified in the literature. The majority of the variables retrieved from the BPS: 12/17 were student-level (e.g., gender, race, major, stopout, GPA, meetings with an academic advisor).

As the BPS:12/17 did not capture all relevant information on institutions and states, I incorporated data from additional sources in order to address my research questions. The data used to conduct this analysis were pulled from multiple sources that are listed in Table 3.1, which also notes which data sources were key to addressing the different RQs.

Table 3.1. *Data Sources Used*

Source	Data	RQs	Rationale
NCES	BPS:12/17	All	BPS:12/17 data were used to create all student level variables and the outcome variables
NCES	IPEDS	2 and 5	IPEDS data were used to create five of the six institution-level variables
U.S Commerce Department Bureau of Economic Analysis	County unemployment rate for 2011	2 and 5	BEA data were used to calculate the institution-level variable of local unemployment rate
Community College Baccalaureate Association	Listing of participating community college baccalaureate programs in each state with the year of inception	None	Used to identify community college baccalaureate programs for removal
Education Commission of the States	Transfer and articulation policies by state: December 2010	3 and 6	Used to create state-level variables related to transfer and articulation policies

The majority of institution-level variables were obtained from the Integrated

Postsecondary Educational Data System website (IPEDS) (Integrated Postsecondary Educational

Data System, n.d.). IPEDS data comes from an annual survey conducted by NCES of all

institutions of higher education that participate in the federal student financial aid program. It

aggregates data on a myriad of variables that include enrollment numbers, completion,

graduation rates, faculty and staff, finances, tuition and fees, and student financial aid (NCES,

n.d.). The second source of institution-level data was the county unemployment rate drawn from

the U.S. Department of Commerce Bureau of Economic Analysis (2019); this measure provides

some additional contextual information to understand the local labor market, which might

influence college student incentives and outcomes. A final source was information on

community college baccalaureate programs obtained by consulting the Community College

Baccalaureate Association website (Community College Baccalaureate Association, 2018).

When the Community College Baccalaureate Association website did not provide the required

specificity on which academic programs were baccalaureate, I consulted the websites of the

specific institutions.

I acquired information on state-level variables from a summary of transfer and

articulation profiles for all 50 states in 2010 compiled by the Education Commission of the

States (Smith, 2010). This summary evaluates each state on seven metrics related to transfer and

articulation (statewide articulation and transfer policy, cooperative agreements, transfer data

reporting, incentives and rewards, statewide articulation guide, common-core curriculum,

common-course numbering). These data were selected over the more recent profiles provided by

the Education Commission of the States as they were compiled just before the launch of

BPS:12/17, helping to ensure the variables created in the data set for state-level variables reflects

the realities that existed at the time.

Sample Restrictions

I used the following inclusion criteria to build the analytic sample:

1. Included in the BPS survey

2. Initially enrolled at a public, not-for-profit two-year institution

3. Not enrolled in a community college baccalaureate program

There are 22,532 students in the complete BPS:12/17 data set. Of these, 6,523 students were

enrolled in public community colleges. I dropped three students from the sample for potentially

being enrolled in a community college baccalaureate program, which would make them unlikely

to have transfer aspirations. I also planned to restrict the sample to exclude co-enrolled students

but found the data was not constructed in a way to identify co-enrollment. The final analytic

sample consisted of 6,520 community college students. The analytic sample is representative of first-time community college entrants who did not enroll in a community college baccalaureate program.

Software and Data

I used Stata version 15 to process and analyze the data. The data are available in a format compatible with Stata (e.g., Stata data sets, comma-delimited files, text files).

Analytic Approach

To address my research questions, I use multilevel logistic regression (Raudenbush & Bryk, 2002) with random effects at the institution level and state level. When data are hierarchically structured or nested, individual observations are not independent, and violations of the independence assumption likely inflate the type I error (Stevens, 2007). A common example of this nesting is students nested within classrooms that are nested within schools. A solution to this is multilevel modeling, which recognizes the existence of these hierarchies by allowing for residual terms at each level of the hierarchy (Raudenbush & Bryk, 2002). As an example, a two-level model that allows for grouping of students within classrooms would include residuals at the student and classroom level. The classroom residuals, which measures between-classroom variation, represent unobserved classroom characteristics that affect student outcomes. The within-classroom residuals reflect the variance of student-level residuals.

Because the outcomes are dichotomous —vertical transfer and baccalaureate attainment, I will perform a logit transformation before analysis:

$$\text{Logit}(p) = \ln(p/(1-p)) \qquad (1)$$

where the outcome now represents the log odds of success or vertical transfer. The logit transformation ensures that the predicted outcome (e.g., probability of transfer) lies within the 0-

1 bounds, allowing for a more realistic representation of the curvilinear association due to the dichotomous outcome variable, and it tends to linearize the association between the predicted outcome and the set of predictors (Raudenbush & Bryk, 2002).

I initially attempted to fit three-level models for both vertical transfer with students nested within schools and schools nested within states. However, the model for baccalaureate attainment did not converge, so I fit two two-level analyses (students within institutions and students within states) for vertical transfer and baccalaureate attainment. The basic two-level logistic regression model is presented below, where there are n_j students nested within each of $j = 1,…,J$ schools (or states). At level-1, the outcome $\text{Logit}(p)_{ij}$ for case i within the level-2 unit j is

$$Logit(p)_{ij} = \pi_{0j} + \sum_{p=1}^{P} \pi_{pj} a_{pj} + e_{ij} \tag{2}$$

$$e_{ij} \sim N(0, \sigma^2) \tag{3}$$

At level-2, the π coefficients at level-1 are treated as outcomes to be predicted, yielding

$$\pi_{pj} = \beta_{p0} + \sum_{q=1}^{Q_p} \beta_{pq} X_{qj} + r_{pj} \tag{4}$$

The β_{pq} are level-2 coefficients, the X_{qj} are level-2 predictors, and r_{pj} is the level-2 random effect.

A precondition for multilevel models to be accurate and informative is that the outcome variable must significantly vary across higher level units of measurement (Raudenbush & Bryk 2002). A common method for determining this variation is the intra-class correlation (ICC), which estimates the variance in the outcome variable that can be attributed to the differences in higher-level units of measurement. Because the outcome variables are dichotomous (transferred vs. not transferred; earned baccalaureate vs. not earned), the variance of the outcome variable is not normally distributed at the base (student) level, making the ICC a less than ideal means of determining variation within higher level units of measurement. As an alternative, I followed the suggestion of Raudenbush and Bryk (2002) and examined plots of estimates of Empirical Bayes

residuals to determine whether the outcome variable varied meaningfully across higher-level units of measurement. This approach has been used in several published papers (Eagan & Jaeger, 2009; Hurtado, Eagan, Cabrera, Lin, Park, & Lopez, 2008; Titus, 2004). The plots of Empirical Bayes residuals are presented in Tables A1-A4 and suggested enough variation to proceed with the multilevel analysis.

Strategy for Addressing Missing Data

Social research, particularly research that relies on surveys, is typically plagued with missing data. Skipped responses, or data that is missing through some other mechanism, can potentially distort the results of statistical analyses (Allison, 2002). A variety of procedures for addressing missing data have been proposed over the years, including listwise deletion, mean replacement, and single imputation. I employed multiple imputation (MI), which entails averaging the outcomes across multiple imputed data sets. Multiple imputation is considered by many statisticians and applied researchers to be the most suitable choice for addressing missing data (Manly & Wells, 2015).

There are multiple steps in conducting MI. First, I performed a missingness analysis to determine the extent and type of missingness. If treatment of missing data is warranted, the specific MI strategy used was Markov Chain Monte Carlo (MCMC) estimation as it is widely used and does not require missing data to be monotone (Allison, 2001). The outcome variable is included as this improves the imputation of independent variables (Little, 1992; Little & Rubin, 2019). I did not transform skewed variables as transforming a variable to meet normality assumptions prior to imputation can result in more bias than just imputing the skewed variable (von Hippel, 2012). The number of imputed data sets will follow Bodner's (2008) recommendation to match the largest percentage missing for the independent variables. For this

analysis, the largest percentage of missing data was for the factor variable of father's education, which was approximately 15%, so 15 imputed data sets were created.

Survey Weighting

Although there is broad agreement that using survey weights is appropriate for descriptive statistics (Kish & Frankel, 1974), there is debate about using weights with inferential statistics (e.g., Gelman, 2007; Hahs-Vaughn, 2005; Kott, 2007; Winship & Radbill, 1994). Proponents of weighting assert that applying survey weights in analyses using complex sampling designs allows generalizing to a broader population (Hahs-Vaughn, 2005; Thomas & Heck, 2001). Critics assert that survey weighting is messy, as it is not always clear how to properly apply weights for anything more sophisticated than a means or ratio. Additionally, the use of weights complicates the calculation of standard errors (Gelman, 2007; Solon, Haider, & Wooldridge, 2015; Winship & Radbill, 1994). Gelman (2007) notes that the variables used in survey weighting and stratification follow the same principles for Bayesian statistics, which implies that models for survey responses should be constructed using all variables that affect probability of inclusion and nonresponse. This may lead to overly complicated models with potentially thousands of poststratification cells, creating significant challenges in developing appropriate probability models. It can be extremely challenging to properly incorporate all variables that affect the probability of inclusion and nonresponse, eroding the ability to generalize from the survey sample to the population of interest. Critics and proponents agree that research to date on the use of weights is negligible and is an open area of research (Gelman, 2007; Hahs-Vaughn, 2005; Stapleton, 2018).

Given concerns over how survey weights influence standards errors, I ultimately decided to use survey weights for descriptive statistics, but not for the main multilevel analyses.

Although using unweighted data will limit the generalizability of my results to the analytic sample, research suggests that unweighted multilevel analysis results are robust to the consequences of not using weights because the model accounts for clustering within first-stage sampling units (institutions), which is of the greater threat to validity when ignored as Type I error rates may be inflated due to underestimation of standard errors (Stapleton, 2018).

Centering Data

Selecting a centering strategy for multilevel modeling is more complex than it is for single-level analysis. One option is not to center variables, where the intercept can be interpreted as the expected outcome for a student in school j that who has a value of zero on all of the independent variables. Another option is grand-mean centering (GMC), where the intercept can be interpreted as the overall mean of all independent variables. Finally, there is group-mean centering, also referred to as centering within-cluster (CWC), where the intercept can be interpreted as the expected outcome for a student in cluster j (or institution in cluster k), whose covariate values are equal to the cluster mean (Raudenbush & Bryk, 2002). Compared with not centering, GMC will only change the intercept and will not change the parameter estimates. While there are instances where CWC will produce the same parameter estimates as GMC or not centering, typically, the approach will produce different estimates (Enders & Tofighi, 2007).

The choice of centering strategy depends on the goals of the researcher. If a researcher is interested in interpreting the intercepts, it is typically advisable to center (Fox, 2016). When using CWC, centered scores are uncorrelated with cluster-level variables and the resulting coefficient is a pure estimate of the estimate between the covariate and the outcome (Enders & Tofighi, 2007). When the goal is to assess the effect of cluster-level independent variables on student-level outcomes, CGM (or not centering) is ideal (Enders & Tofighi, 2007). As the

emphasis of this study is on institution and state-level effects on student outcomes and I was not focused on interpretating the intercept, I did not center variables in this analysis.

Included Variables

Descriptions of the variables included in the analysis are presented in Table 3.2.

Table 3.2. *Description of variables.*

Variable name	Description	Variable type	Source
Student level variables			
Female	Student is female (reference group: male)	binary	BPS
Race/ ethnicity	"Black", "Hispanic", "Asian", "Other race", and "White" (reference group)	categorical	BPS
Dependent status	Student was a dependent in 2011-12 (reference: independent)	binary	BPS
Delayed enrollment	Number of years the student delayed enrollment	continuous	BPS
Age	Age of the respondent as of 12/31/2011	continuous	BPS
Marital status	Student is married (reference: student is single, divorced, or separated)	binary	BPS
Dependent child	Student had at least one dependent child in 2012 (reference: no dependent children)	binary	BPS
SES	A factor score created from father's education (PDADED), mother's education (PMOMED), and mean family income (CINCOME); I include the factor analysis results in Appendix Table B1	continuous	BPS
Unmet need	Gap between student budget and financial resources available from family and financial aid	continuous	BPS
Employment	Amount of time student worked in a job weekly: part-time; full-time or no job (reference)	categorical	BPS
Engagement	Factor score for four BPS measures of engagement in 2011: BELONG (felt like part of institution), SOCSTATIS (satisfaction with social experience first year), FACULTY (interactions with faculty in 2012); STUDYSAT (satisfaction with studies) I include the factor analysis results in Appendix Table B2	continuous	BPS

Table 3.2. *Description of variables (continued)*

Baccalaureate expectations	Indicates 2012 bachelor's program intention with five years (Reference: no baccalaureate expectations in 2012)	binary	BPS
Took remedial courses	Student took one or more remedial courses in 2011-2012 academic year	binary	BPS
Transfer oriented major	Student is enrolled in a transfer-oriented program (reference: student is enrolled in vocational program)	Binary	BPS
Academic advising	Student met with academic advisor at least once in 2011-2012 academic year	binary	BPS
Stopout	Student stopped out one or more times at first institution (Reference: did not stop out)	binary	BPS
Horizontal transfer	Transferred to another two-year institution prior to enrolling at four-year institution (reference: did not horizontally transfer)	binary	BPS
Major switch	Student switched majors at least once while enrolled as a CC student (reference: stayed in original major)	binary	BPS
Enrollment intensity	"Enrolled part-time" (reference); "enrolled mixed part-time and full-time"; or "enrolled full-time" during the 2011-2012 academic year	binary	BPS
GPA	Grade point average for first year at community college	continuous	BPS

Institution level variables

Revenue from state	Amount of revenue from state per FTE in 2011	continuous	IPEDS
Instructional expenses	Instructional expenses per FTE in 2011	continuous	IPEDS
Percent Pell recipient	Percent of students at each school receiving the federal Pell grant in 2011-2012	continuous	IPEDS
Expenditures per student	Average expenditures per student for an institution in 2011-2012	continuous	IPEDS
Net price	Estimated net price for full-time student at the institution for Fall 2011	continuous	IPEDS
Faculty to student ratio	Ratio of full-time faculty to students in 2011-2012	continuous	IPEDS
County unemployment rate	Percentage of residents that are unemployed in county of the institution the student first attended	continuous	BEA

Table 3.2. *Description of variables (continued)*

State level variables			
Cooperative agreements	Presence of cooperative agreements between postsecondary institutions that allow for articulation on course-to-course, department-to-department, or institution-to-institution basis (reference: no cooperative agreements in state	binary	ECS
Transfer data reporting	State collects data on transfer and student persistence (reference: no method for collecting transfer and persistence data)	binary	ECS
Incentives and rewards	State provides extra incentives to encourage vertical transfer by offering financial aid, guaranteed transfer, or priority admission (reference: no incentives offered)	binary	ECS
Statewide articulation guide	State provides guide for students with concrete descriptions of the transfer process and the requirements (reference: no guide available)	binary	ECS
Common core curriculum	State has a general education core curriculum that streamlines articulation process (reference: state has no core curriculum)	binary	ECS
Common course numbering	State mandates identical course numbering for similar courses between public 2-year and 4-year institutions to facilitate transfer (reference: state has no common course numbering)	binary	ECS
Outcome Variables			
Vertical Transfer	Captures whether the student transferred to a four-year institution within the six-year period of the study	binary	BPS
Baccalaureate Attainment	Captures whether the student earned a baccalaureate within the six-year period of the study	binary	BPS

As shown in Table 3.2, my analyses include a number of student-level variables, driven

by the literature on predictors of transfer and degree attainment among two-year college entrants,

including demographic measures and variables that capture student experiences, like enrollment

intensity or meeting with an advisor during the first year of college. I also include institution-

level variables that capture institutional resources, including revenue from the state and per

student expenditures, and contexts, like the region's unemployment rate and the institution's

percent Pell recipients. Finally, I include state-level variables from the ECS, which include some

very broad measures, like the presence of a "statewide articulation and transfer policy," and more narrowly defined measures, like whether the same uses common course numbering (universal course numbers for lower-division courses) or has a common core curriculum (a set of general education courses).

State with a statewide articulation and transfer policy vary widely, as the construct captures a broad spectrum of policies were in place with varying degrees of implementation. At one end of the spectrum, California has a comprehensive system that requires each department, school, and major in the University of California, California State University, and public community college system to devise discipline-specific articulation and transfer agreements (CAL EDUC. CODE § 66740) and also held governing boards of these institutions accountable for implementation of these policies (CAL EDUC. CODE § 66738). Policies for other states were not nearly as comprehensive. As one example, Massachusetts, at the time of analysis, encouraged but did not mandate "coordination of programs between public secondary vocational-technical school districts and public institutions of higher education," without providing specific guidance on how to do so (MASS. ANN. LAWS CH. 74, §24B). For this reason, I am cautious about putting too much stake in the role at having a statewide articulation and transfer policy plays, given the wide variation in what that can mean. Cooperative policies between institutions often can exist even in the presence of a broader statewide transfer agreement. As with statewide articulation and transfer policy, there was also a wide variety of reported cooperative agreements in the ECS data. For Arizona, it was reported as a simple "yes", for Massachusetts, it was just reported as "negotiated between individual schools (Smith, 2010), while Nebraska was much more specific and indicated that since 1995, twenty-seven

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public and private colleges and universities participate in the Nebraska Transfer Initiative (Smith, 2010).

Addressing Multicollinearity

Multicollinearity is the presence of high intercorrelations between two or more independent variables in a regression model. Moderate multicollinearity may not be problematic, but severe multicollinearity can lead to misleading results. It can increase the variance of the estimates, making them very sensitive to minor changes in the model, potentially even causing the signs of the coefficient to change, making it unstable and very difficult to interpret (Fox, 2016). There is a variety of way to deal with multicollinearity, from standardizing affected independent variables, linearly combining them, or creating a factor variable which includes all of the collinear predictors. The most frequently used method for addressing multicollinearity is to remove collinear variables, retaining only one. I use this approach in my preferred model, but show the full model—with all the variables—for comparison.

To identify multicollinearity, I first generated correlation matrices for each level of analysis (see Appendices C1-C3). For each comparison, I selected the most appropriate correlation for the type of variables being examined. I used a Pearson product-moment correlation (Pearson, 1909) when comparing two or more continuous variables. I used a Cramer's phi coefficient (Cramer, 1946) or a tetrachoric correlation (Pearson, 1901) when comparing two or more dichotomous variables and a point-biserial correlation when comparing one dichotomous variable with one continuous variable. (Glass and Hopkins, 1995). I leverage the phi coefficient to test two truly dichotomous variables (e.g. gender, horizontally transferred). I used the tetrachoric correlation to test state-level variables. An assumption of the tetrachoric

correlation is that the underlying distribution is continuous and not truly dichotomous. I felt the tetrachoric correlation was appropriate with these state level variables as there is an underlying distribution that extends beyond "present" and "not present." As one example, a state could have no cooperative agreements, an agreement between one two-year institution and one four-year institution, or multiple agreements between multiple two and four-year institutions, or anything in between, yielding a distribution of implementation of cooperative agreements as opposed to a simple dichotomy. I chose a correlation of approximately 0.60 or higher as the standard for identifying potentially multicollinear variables. To select which variables to include among correlated measures, I made a subjective determination based on either ease of interpretation or value to researchers and policymakers, along with considering the variables' relationships with the outcomes of interest.

Strengths and Limitations

The strength of this analysis is it leverages nationally representative data and accounts for naturally occurring dependence in our data, resulting in more accurate standard errors and a type I error rate that is closer to nominal. The ability to examine variables at various levels—individual, institution, and state—can contribute to our knowledge of predictors of community college transfer, teasing apart individual predictors from contextual predictors.

Some limitations of using this approach are that it does not allow for the detailed description of unique student experiences, as we might obtain from a qualitative approach, nor does it allow for analysis of indirect effects that a structural equation modeling approach would provide. Another is that state-level variables provided by ECS are not ideal for an analysis because they are binary (present/not present) and sometimes appear to obscure the variation that exists in the data (e.g., the example I note above with the "statewide articulation and transfer

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policy" measure). As with virtually all observational research, there is the potential for omitted variable bias, where one or more relevant variables are omitted, impacting the interpretation of results. However, an advantage of the BPS:12/17 is that it includes a rich set of variables that allow for the inclusion of variables known to be related to our outcomes of interest. Finally, as there is no random assignment to conditions, the results of this analysis should be interpreted as correlational and not causal.

Summary of Chapter

This chapter outlines a strategy for using multilevel logistic regression to identify student, institution, and state-level predictors of vertical transfer using the BPS 2012-2017 data that will hopefully inform policy decisions by school officials and legislators. I selected the methodological approach to minimize distortion due to clustering within higher-level factors, as it will provide the clearest picture possible of the effect of the variables of interest—at the state, institutional, and individual levels—on vertical transfer and baccalaureate attainment.

Chapter Four: Results

This study examines how student-level (student characteristics and college experiences), institution-level, and state-level variables influence vertical transfer and subsequent graduation of students that begin at community colleges. I used multi-level modeling to address the following research questions:

1. To what extent do student-level variables influence vertical transfer among public two-year college entrants?

2. To what extent do institution-level variables predict vertical transfer among public two-year college entrants?

3. To what extent do state-level variables predict vertical transfer among public two-year college entrants?

4. To what extent do student-level variables influence baccalaureate attainment among public two-year college entrants?

5. To what extent do institution-level variables predict baccalaureate attainment among public two-year college entrants?

6. To what extent do state-level variables predict baccalaureate attainment among public two-year college entrants?

In this chapter, I present descriptive statistics for all variables in my models. I then present results from two MLM models for each outcome (vertical transfer and bachelor's degree attainment). The first model includes all proposed variables described in the methods chapter. The second, and preferred model, addresses multicollinearity by removing variables that are correlated.

Descriptive Statistics

Table 4.1 presents the descriptions and population weighted summary statistics for variables included in the study. The average age for students included in the sample was 20.8 years old. Approximately 56% of the students were female. The majority of students identified as White (57%), followed by Hispanic (24%) and Black (11%). Only 7% of students were married, and roughly 11% had at least one dependent child. The average family income in 2011 was about $52,289, and the average unmet need—the gap between student's Expected Family Contribution (EFC) and total aid—was $3,290. Over half of the students were not employed in the 2011-2012 school year; 28% had a part-time job, and 18% were enrolled full-time.

With respect to academic variables, just over half of the students were enrolled full-time in the fall of 2011; 29% were enrolled part-time and 18% were not enrolled for the Fall 2011 semester, but did enroll for the Spring 2012 semester. Most students (63%) enrolled in a transfer-oriented major and 37% enrolled in a vocational major. Fourteen percent of the students stopped out at some point, 13% transferred to another less than four-year institution, and 37% switched majors at least once between the two broad major categories of "transfer oriented" or "vocational." Despite only 63% being enrolled in a transfer oriented major in 2011, 78% indicated they expected to earn a baccalaureate degree within five years. I created factor variables for student SES and student engagement (variables used to create the factor variables and their subsequent loadings are presented in Appendices B1 and B2).

Of the institutions included in the sample, the average estimated net price in 2011 for students was $6,781. The average amount of revenue received from the state for every full-time student was approximately $3,083 and the average amount spent on instructional expense per every full-time student s was $4,506. On average, 56% of students at sampled institutions were

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awarded a Pell Grant. For every instructor, there were 23 students on average. The average unemployment rate of the counties these institutions were located in was 9.4%. This is higher than the historical average, but it was only a few years after the Great Recession, and the U.S. labor market had not completely recovered by 2011.

Ninety-three percent of states had institutions with cooperative agreements—this highlights the issue that I noted in the methods chapter, in which most states have some sort of transfer policies, which can render this construct less meaningful than some of the more specific measures. Sixty-nine percent of states had an articulation and transfer guide. Seventy-four percent of institutions had a common set of core courses (general education courses that fulfill basic requirements at institutions across the state). Still, only 37% of states had a course numbering system that was uniform across all public institutions for lower-division courses.

Table 4.1. *Descriptive Statistics of Analytic Sample*

Variable	Mean	SD
Dependent Variable		
Vertical transfer	0.297	0.457
Baccalaureate attainment	0.150	0.357
Student Level Independent Variables		
Female	0.559	0.497
Race		
White	0.565	0.496
Black	0.112	0.316
Hispanic	0.236	0.425
Asian	0.039	0.195
Other	0.047	0.212
Age	20.801	6.167
Married	0.071	0.257
Dependent children	0.108	0.310
Unmet need	3700.923	4204.890
SES	0.00	1.000

Table 4.1. Descriptive Statistics of Analytic Sample (continued)

Family income	52,288.950	52757.500
Ordinal indicator of mother's education		
No college	0.449	0.497
Some college	0.291	0.454
Bachelor's degree	0.140	0.347
Post-graduate degree	0.054	0.225
Ordinal indicator of father's education		
No college	0.461	0.499
Some college	0.237	0.426
Bachelor's degree	0.117	0.321
Post-graduate degree	0.065	0.247
Engagement factor	-0.045	0.992
Experiences - interaction with other students	4.278	0.908
Experiences - belonging at the institution	3.848	1.138
Experiences - interaction with faculty	4.321	0.914
experiences - satisfaction with studies	4.120	1.034
Academic advising	0.531	0.499
Delayed enrollment	1.995	5.008
Major in 2012		
Transfer	0.630	0.483
Vocational	0.370	0.483
Major switch	0.565	0.496
Stopout	0.144	0.352
Horizontal transfer	0.133	0.340
GPA	2.824	0.914
Baccalaureate expectation	0.783	0.412
Enrollment intensity		
Not enrolled	0.203	0.402
Enrolled part-time	0.293	0.455
Enrolled full-time	0.504	0.500
Employment		
No job	0.537	0.499
Part-time job	0.281	0.449
Full-time job	0.183	0.386

Table 4.1 Descriptive Statistics of Analytic Sample (continued)

Institution-level Independent Variables		
Revenue from state per FTE	3082.759	2820.342
instructional expenses per FTE	4498.884	1454.550
Percent Pell	55.663	14.237
Net price	6781.703	2592.607
Student-faculty ratio	23.106	6.524
Unemployment rate	9.410	2.411
State-level Independent Variables		
Cooperative agreements	0.938	0.242
Transfer data reporting	0.869	0.338
Incentives and rewards	0.573	0.495
Statewide articulation guide	0.693	0.461
Common core	0.739	0.439
Common course numbering	0.372	0.483

Notes. N = 6,520. Table presents means and standard deviations for all predictors in the full analytic model.

Results for Vertical Transfer

The results for the multilevel analysis of variables predictive vertical transfer are presented in Table 4.2. To address RQ1, I describe the results for student-level predictors in Model 2 because results from Model 1 and Model 2 largely align. I point out the meaningful differences when they do not align. Identifying as a woman resulted in a three-percentage-point increase in the probability of vertical transfer (*AME* = .032, *SE* = .014, *p* = .003). Black and Asian students were both more likely to vertically transfer than White students (Black: AME = .047, SE = .022, p = .015; Asian: AME = .108 SE = .034, p = .001).

Age was negatively associated with vertical transfer. For every two-year increase in the student's age, the probability of vertical transfer dropped by approximately one and a half percentage points (*AME* = .008, *SE* = .002, *p* = .000). This finding is consistent with those of LaSota & Zumeta (2016), who found that students aged 15 to 19 were more likely to transfer vertically than students who were 20 or over. In this analysis, age is one of the student-level

variables that significantly covaried with other student-level predictors (dependent status, delayed enrollment). When comparing the results for Model 2 (age only) to Model 1 (age, dependent status, and delayed enrollment), age is the only variable that significantly covaries with vertical transfer. As a test, I included all three variables individually and found that all three covaried with vertical transfer to a statistically significant degree. I selected age, out of the variables that were multicollinear with one another, as it was the most conceptually straightforward (the other measures seemed to also capture age of student) and demonstrated the strongest relationship with the dependent variable. Removing these colinear variables also changed the result for having dependent children. Once dependent status and delayed enrollment measures were removed, the relationship between having dependent children and vertical transfer became statistically significant, where having dependents was associated with an almost seven-percentage-point decrease in the probability of vertical transfer (AME = -.067, SE = .027, p = .014). This change is most likely because having dependent children was modestly correlated with the above three variables, and this multicollinearity was enough to cloud the relationship of interest. Socioeconomic status was positively related to vertical transfer attainment (AME = .048, SE = .007, p = .000). Having a part-time job was positively related to vertical transfer (AME = .034, SE = .016, p = .027).

Several other student experiences appear to predict vertical transfer, including bachelor's degree expectations, being in a transfer-oriented major, and stopping out. Students who indicated in their first semester that they intended to earn a baccalaureate within five years are almost fourteen percentage points more likely to experience vertical transfer than for students with no such expectations (*AME* = .138, *SE* = .017, *p* = .000). Students enrolled in transfer-oriented majors were more likely to vertically transfer than students enrolled in vocational majors by

about four percentage points (*AME* = .042, *SE* = .014, *p* = .002). Students who stopped one or

more times at their first institution had a reduced probability of vertically transferring of almost

ten percentage points (AME = -.096, SE = .020, p = .000). Not surprisingly, students who

attended full-time were significantly more likely to vertically transfer than part-time students

(AME = .138, SE = .016, p = .000).

I also found that students who visited with an academic advisor at least once during their

first year had a significantly higher probability of vertical transfer than students who did not,

where those who visited an academic advisor had a predicted probability of transfer over four

percentage points higher than for students who did not meet with an academic advisor (AME =

.041, SE = .013, p = .002). The engagement factor was negatively associated with vertical

transfer (AME = -0.014, SE = .007, p = .036). At first glance, this result seems perplexing.

However, a possible explanation is that students who intended to earn a degree or certificate

from a two-year institution may become more integrated into their first institution if they intend

to graduate from it than a student intending to transfer to another institution.

Somewhat surprisingly, switching between majors while enrolled at a two-year institution

did not adversely affect the probability of vertical transfer (AME = .017, SE = .013, p = .218).

This may be due to the fact the measure did not distinguish between major switches within meta-

majors, where much of the taken coursework would count towards the new major, and between

meta-majors, where much of the taken course work may end up not counting.

Table 4.2 *Multilevel Logistic Regression Model Predicting Vertical Transfer*

Variable	Model 1			Model 2		
	AME	s.e.		AME	s.e.	
Student Level Independent Variables						
Background Characteristics						
Female	0.032	0.014	*	0.032	0.014	*

Table 4.2 *Multilevel Logistic Regression Model Predicting Vertical Transfer (continued)*

Ethnicity						
Black	0.047	0.022	*	0.046	0.022	*
Hispanic	0.006	0.018		0.008	0.018	
Asian	0.110	0.034	**	0.108	0.034	**
Other	0.019	0.031		0.018	0.031	
Dependent status	0.048	0.025	†	-	-	
Delayed enrollment	-0.001	0.003		-	-	
Age	-0.005	0.003	*	-0.008	0.002	**
Marital status	0.022	0.036		0.012	0.035	
Dependent children	-0.042	0.030		-0.067	0.027	**
SES	0.046	0.007	**	0.048	0.007	**
Unmet need	-0.002	0.002		-0.002	0.002	
Employment						
part-time job	0.033	0.016	*	0.034	0.016	*
full-time job	-0.033	0.019	†	-0.033	0.018	†
College Experiences						
Engagement factor	-0.014	0.007	*	-0.014	0.007	*
Baccalaureate expectation	0.138	0.017	**	0.138	0.017	**
Took remedial course	-0.018	0.014		-0.018	0.014	
Transfer-oriented major	0.041	0.014	**	0.042	0.014	**
Academic advising	0.042	0.013	**	0.041	0.013	**
Stopout	-0.086	0.020	**	-0.088	0.020	**
Horizontal transfer[a]	0.000	(omitted)		0.000	(omitted)	
Major switch	0.017	0.013		0.017	0.013	
Enrollment intensity						
Not enrolled	-0.022	0.020		-0.025	0.020	
full-time student	0.135	0.017	**	0.136	0.017	**
GPA	0.076	0.008	**	0.076	0.008	**
Institution-level Independent Variables						
Revenues from state	-0.002	0.003		-0.002	0.003	
Instructional expenses	-0.006	0.006		-0.006	0.006	
Percent Pell	-0.001	0.001	*	-0.001	0.001	*
Net price	-0.003	0.003		-0.003	0.003	
Student-faculty-ratio	0.000	0.000		0.000	0.000	
County Unemployment rate	0.004	0.003		0.004	0.003	

Table 4.2 *Multilevel Logistic Regression Model Predicting Vertical Transfer (continued)*

State-level Independent Variables						
Cooperative agreements	0.067	0.029	*	0.067	0.029	*
Transfer data reporting	0.014	0.022		-	-	
Incentives and rewards	-0.020	0.017		-0.013	0.017	
Statewide articulation guide	0.035	0.016	*	0.033	0.017	*
Common core	-0.015	0.021		-0.008	0.018	
Common course numbering	-0.002	0.015		-	-	

Note. $N = 6,520$. This table combines results for two 2-level models. The first has students nested within institutions and the second has students nested within states. Student level and institution-level values are taken from the first model and state-level values are taken from the latter model. Model 1 includes all proposed variables. Model 2 includes all variables and centers them. Model 3 is the preferred model where multicollinear variables were removed.
† $p < .10$, * $p < .05$, ** $p < .01$
[a] Stata failed to produce a result for horizontal transfer because of dependency in the data. To identify specifically where the dependency was, I regressed horizontal transfer on the remaining IVs. The results suggested Black was the strongest predictor of transferring horizontally (AME=.09, p=.000), followed by GPA and gender. As horizontal transfer is a more informative variable, I ran the analysis omitting GPA, but Stata still failed to produce results for horizontal transfer.

To address research question #2, I begin by describing the results for institution-level variables on vertical transfer. As measured by the percentage of students receiving Pell grants, the socioeconomic composition of the community college appears to be negatively associated with vertical transfer (AME = .0012, SE = .0005, p = .024). For every eight-percentage-point increase in Pell students at a college, the probability of vertical transfer dropped by one percentage point. The other institutional-level models did not appear to significantly predict vertical transfer in either the full or preferred model.

To address research question #3, I describe the significant relationship for state-level predictor variables on vertical transfer. When all proposed variables are included, cooperative agreement was significantly related to vertical transfer. The presence of a cooperative agreement within the state was associated with an increase in the probability of vertical transfer of nearly six percentage points (AME = .067, SE = 0.029, p = .019). The presence of a statewide

articulation guide was also related to vertical transfer (AME = .033, SE = 0.017, p = .050). In an attempt to parse out the effects of individuals state-level variables, LaSota & Zumeta did test each state-level variable individually within subpopulations that vary by state and found an effect for common-course numbering, but not state articulation guide or cooperative agreements. To see if I could replicate this finding, I tested each state-level variable individually but still only identified an effect for cooperative agreements and statewide articulation guide. These results are presented in Appendix D.

Results for Baccalaureate attainment

The results for the multilevel analysis for baccalaureate attainment are presented in Table 4.3. The results across the full and preferred model were quite similar and I interpret the results from the final preferred model in the paragraphs throughout this section.

To address research question #4, I describe the results for student-level variables on baccalaureate attainment. As with vertical transfer, identifying as a woman was positively related to the outcome, where women appeared slightly more likely to earn a baccalaureate than men (*AME* = .018, *SE* = .009, *p* = .042). Although Black students were significantly more likely to vertically transfer than White students, they were significantly *less* likely to earn a baccalaureate (*AME* = -.033, *SE* = .014, *p* = .025). Similar to vertical transfer, the age of the student was negatively related to baccalaureate attainment. For every three-year increase in age, the predicted probability of earning a baccalaureate dropped by just over one percentage point (AME = -.004, SE = .001, p = .004). Student SES was positively related to baccalaureate attainment. For every one standard deviation increase in the SES factor score, the probability of earning a baccalaureate increased by approximately three percentage points (AME = .029, SE = .004, p = .000). While marriage status did not seem to affect the probability of baccalaureate

attainment (AME = .014, SE = .029, p = .662), having one or more children was associated with

a more than five-point reduction in the probability of baccalaureate attainment (AME = -.056, SE

= .023, p = .015). The number of hours worked per week was associated with varying

probabilities depending on the number of hours worked. Working part-time was associated with

a more than three percentage point increase in the predicted probability of transfer over students

who did not work (*AME* = .036, *SE* = .010, *p* = .001). However, working full-time was

associated with a decrease in the predicted probability of baccalaureate attainment (*AME* = -.030,

SE = .012, *p* = .01).

Table 4.3 *Multilevel Binary Logistic Regression Model Predicting Baccalaureate Attainment*

Variable	Model 1			Model 2		
	AME	s.e.		AME	s.e.	
Student Level Independent Variables						
Background Characteristics						
Female	0.018	0.009	*	0.018	0.009	*
Ethnicity						
Black	-0.033	0.014	*	-0.033	0.014	*
Hispanic	-0.008	0.012		-0.008	0.012	
Asian	0.037	0.022	†	0.037	0.022	†
Other	-0.024	0.019		-0.024	0.019	
dependent status	-0.001	0.017		-	-	
delayed enrollment	0.004	0.003		-	-	
Age	-0.007	0.003	*	-0.004	0.001	**
Marital status	0.010	0.029		0.014	0.029	
Dependent children	-0.055	0.024	*	-0.056	0.023	*
SES	0.030	0.004	**	0.030	0.004	**
Unmet need	-0.001	0.001		-0.001	0.001	
employment						
part-time job	0.036	0.010	**	0.036	0.010	**
full-time job	-0.030	0.012	*	-0.030	0.012	*
College Experiences						
Engagement factor	-0.009	0.005	†	0.036	0.005	†
Baccalaureate expectation	0.086	0.014	**	0.086	0.014	**
Took remedial course	-0.015	0.009		-0.014	0.009	

Table 4.3 *Multilevel Binary Logistic Regression Model Predicting Baccalaureate Attainment (continued)*

Transfer oriented	0.029	0.009	**	0.029	0.009	**
Academic advising	0.046	0.009	**	0.046	0.009	**
Stopout	-0.062	0.015	**	-0.063	0.015	**
Horizontal transfer	-0.116	0.018	**	-0.116	0.018	**
Major switch	-0.011	0.009		-0.011	0.009	
Enrollment intensity						
not enrolled	-0.014	0.011		-0.012	0.011	
full-time student	0.100	0.010	**	0.099	0.010	**
GPA	0.065	0.006	**	0.066	0.006	**
Institution-level Independent Variables						
Revenues from state	0.001	0.002		0.001	0.002	
Instructional expenses	-0.005	0.004		-0.006	0.004	
Percent Pell	-0.001	0.000		-0.001	0.000	
Net price	-0.001	0.002		-0.001	0.002	
Student-faculty-ratio	0.000	0.000		0.000	0.000	
County Unemployment rate	0.005	0.002	**	0.005	0.002	**
State-level Independent Variables						
Cooperative agreements	0.051	0.021	*	0.049	0.021	*
transfer data reporting	0.003	0.015		-	-	
Incentives and rewards	-0.006	0.012		-0.002	0.012	
Statewide articulation guide	0.014	0.011		0.013	0.011	
Common core	-0.006	0.012		-0.006	0.013	
Common course numbering	0.016	0.011		-	-	

Note. $N = 6{,}520$. This table combines results for two 2-level models. The first has students nested within institutions and the second has students nested within states. Student level and institution-level values are taken from the first model and state-level values are taken from the latter model. Model 1 includes all proposed variables. Model 2 includes all variables and centers them. Model 3 is the preferred model where multicollinear variables were removed. † $p < .10$, * $p < .05$, ** $p < .01$

Moving on to students' academic experiences, students who expected to earn a baccalaureate in their first year had a predicted probability of over eight percentage points higher than those who had no such expectations (*AME* = .086, *SE* = .014, *p* = .000). Enrolling in a transfer-oriented major was associated with a modestly higher predicted probability of transfer when compared to students who enrolled in vocational programs (*AME* = .029, *SE* = .009, *p* =

.000). Students who stopped out had a predicted probability of baccalaureate attainment that was over six percentage points lower than students who did not stop out (AME = -.063, SE = .015, p = .000). Transferring horizontally within the first two years (from one two-year institution to another two-year institution) was associated with an 11-percentage-point reduction in the probability of earning a baccalaureate within six years (AME = .116, SE = .018, p = .000). Students who were enrolled full-time in their first year had a predicted probability of baccalaureate attainment that was ten percentage points higher than students who were enrolled part-time (AME = .099, SE = .010, p = .000). Finally, meeting with an academic advisor at least once in their first year at a two-year institution was associated with an increase in the probability of earning a baccalaureate of almost five percentage points (*AME* = .046, *SE* = .009, *p* = .000).

To address research question #5, I describe the effects of institution-level variables on baccalaureate attainment. While percentage of Pell recipients predicted vertical transfer, it did not predict baccalaureate attainment, but the county unemployment rate was positively related to baccalaureate attainment. For every two-percentage-point increase in the local unemployment rate, there was a corresponding one-point increase in the predicted probability of baccalaureate attainment (AME = .005, SE = .002, p = .008). This finding supports the body of research that shows an increase in higher education retention when the local labor market takes a downward turn.

To address research question #6, I describe the results for state-level variables on baccalaureate attainment. As with vertical transfer, the presence of a cooperative agreement was associated with a five-percentage-point increase in the predicted probability of baccalaureate attainment (AME = .049, SE = .021, p = .021). Here the presence of a statewide transfer guide was not significantly related to the outcome (AME = .013, SE = .012, p = .202). This finding is

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understandable as a student at a two-year institution contemplating vertical transfer would have more use for articulation and transfer guide than a student who has already transferred to a four-year institution. In Appendix D, I show the state-level results for a supplemental model in which I included each state-level variable individually. This was done to remove the possibility of multicollinearity. The results mirrored those of the full model as only cooperative agreements and statewide articulation guide were significant.

Summary of Chapter

This chapter began with a detailed description of students who attended community colleges in the 2011-2012 academic year. Second, I presented results from multilevel logistic regression models, illustrating which student, institution, and state-level variables are associated with vertical transfer and baccalaureate attainment. This information should provide information practitioners and policymakers can leverage to improve probabilities of success for community college students seeking baccalaureates. The subsequent and final chapter provides a discussion of these results as well as recommendations for future research.

Chapter Five: Discussion

Community colleges serve a variety of purposes, providing high school equivalence training, vocational degrees, continuing education, and offering a transfer pathway to a baccalaureate degree. The transfer function of community college has the potential to improve access and opportunity for all students, but particularly underserved college students—a core mission of the public community college. Understanding the factors associated with the vertical transfer and baccalaureate attainment among community college students is paramount to reverse this trend and buttress this facet of the community college mission. At present, there is a somewhat large body of research that satisfyingly identifies what student background characteristics are associated with academic success, including vertical transfer and baccalaureate attainment. However, research that sheds light on the role of institutional factors and state policies—which may be more actionable for educational leaders and elected officials can to improve these outcomes—is limited.

My dissertation seeks to fill this gap, offering additional insights on actions students, educational administrators, and political leaders could take to enhance community college transfer outcomes. In this study, I used data from multiple sources, but primarily the BPS:12/17, to build a multi-level model that assessed variables at the student, institution, and state level to identify what factors may be associated with vertical transfer and baccalaureate attainment among community college entrants. My analysis identified significant factors at all three levels of analysis. This chapter discusses the key findings of the analysis and how the results align with the extant literature. I describe the results grouped by student-, institution-, and state-level predictors of the transfer outcomes. I conclude with suggestions for policy considerations and future research.

Relationship between Student-Level Measures and College Outcomes

Some of the most studied variables of student success are the background variables of the student. Many well-known student-level predictors of college success were predictive in this analysis, including SES, gender, full-time enrollment, baccalaureate expectations, employment status, age, and having dependent children. Baccalaureate expectations was the strongest predictors of vertical transfer, and this aligns with previous research (Dougherty and Kienzl, 2006; LaSota & Zumeta, 2016). Baccalaureate expectations was closely followed by enrollment status, where full-time students were significantly more likely to vertically transfer and earn a baccalaureate than part-time students. This finding aligns with previous research (Adelman, 2006; Dougherty and Kienzl, 2006; LaSota and Zumeta, 2016; Turk and Chen, 2017). However, some findings in this analysis differ somewhat from the prior literature. Figure 5.1 summarizes the significant predictors of transfer from my analyses.

Figure 5.1 *Variables Significantly Related to Vertical Transfer*
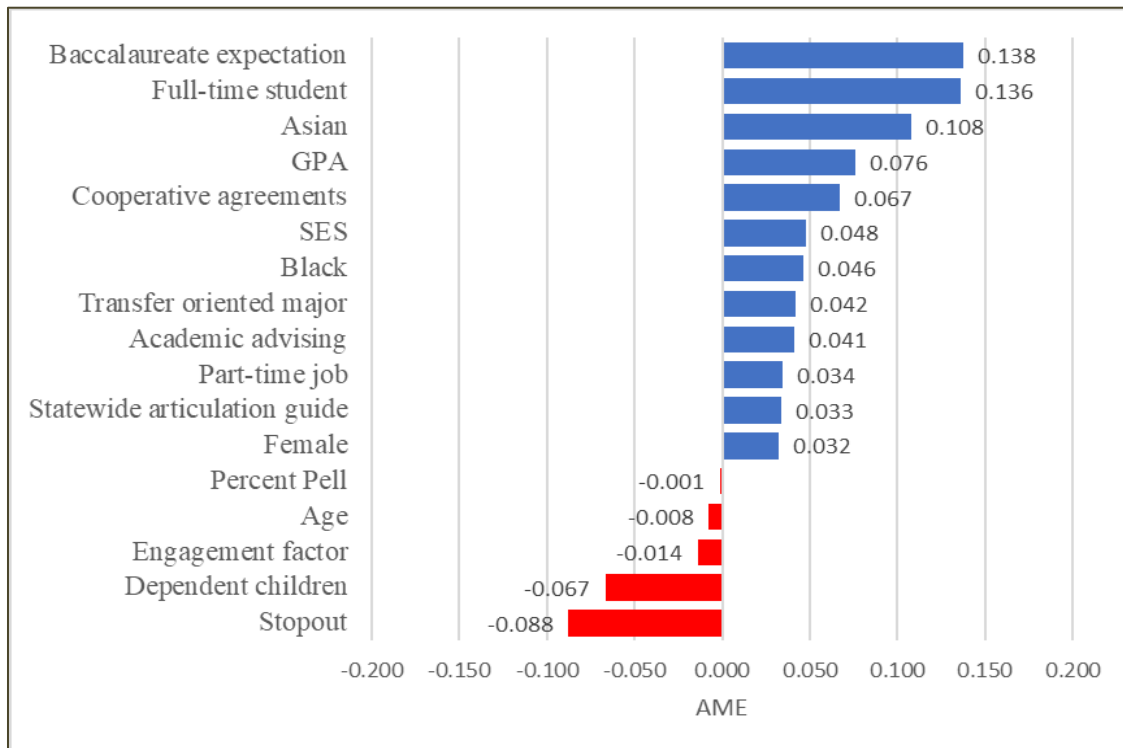
As illustrated in Figure 1 there was some variation in transfer across race/ethnicity, where—after controlling for other variables—the results suggest that identifying as Asian and Black positively predicted transfer compared with identifying as White. In some prior studies, Black students appeared less likely than White students to vertically transfer (Nora & Rendon, 1990; Pincus & Archer, 1989). In a study using two separate datasets, Dougherty & Kienzl, 2006) found mixed results. In the full model for the BPS:90 data, they found that Black students transferred at lower rates than White student. However, in the full model for the National Educational Longitudinal Study of 1988 (NELS88), they found that in the full model, Black students were *more* likely than white students to vertically transfer, thus aligning with the results of this analysis. However, this result did not manifest in baccalaureate attainment, where Black students were less likely to earn a four-year degree than white students. This finding aligns with previous research (Ciocca, 2018; Harper & Simmons, 2019; Nora & Rendon, 1990; Pincus & Archer, 1989; Wang & Wickersham, 2014).

Broad choice of major was related to vertical transfer. Similar to Dougherty and Kienzl (2006) and Lasota and Zumeta (2016), students enrolled in transfer-oriented majors (e.g., humanities, social sciences, STEM, and education) were more likely to transfer vertically than students who chose no major or a health, vocational or technical major. In a break from the findings of LaSota and Zumeta (2016), business majors in this sample had vertical transfer probabilities more in line with transfer-oriented majors than with undeclared students. The differences in major for baccalaureate attainment were not as robust (see figure 2 for significant predictors of baccalaureate attainment). However, there was a difference between the broad categories of "transfer oriented" and "vocational" majors, with undeclared being included with vocational majors and business being included with transfer oriented.

In a somewhat expected finding, results indicated that stopping out was associated with a significantly reduced probability of both vertical transfer and baccalaureate attainment. This finding corresponds with previous research that found stopping out was related to a reduction in the probability of baccalaureate attainment (Alfonso, 2006).

Figure 5.2 illustrates the significant predictors of baccalaureate attainment among community college entrants, controlling for other measures in the model. Similar to the results for vertical transfer, the student-level variables of baccalaureate expectations, full-time enrollment, and GPA were positively and strongly related to the outcome, baccalaureate attainment.

Figure 5.2 *Variables Significantly Related to Baccalaureate Attainment*
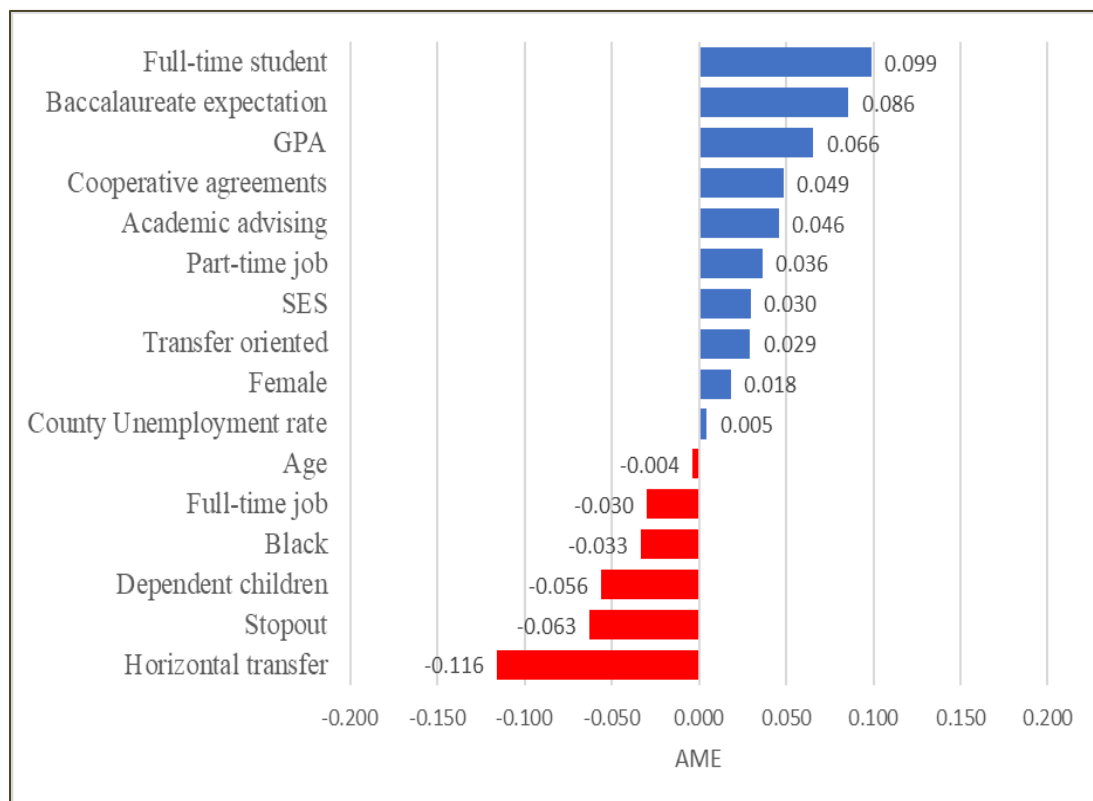
Just as with vertical transfer, stopping out appears to negatively predict baccalaureate attainment. I also found that transferring horizontally was associated with the largest decrease in

the probability of baccalaureate attainment compared with other variables in the model.

Horizontal transfer may negatively predict baccalaureate attainment if previously accrued credits did not transfer to the new institution, requiring the student to retake the courses. Another possibility is that they may have transferred out of a two-year institution with a cooperative agreement to an institution with no such agreement. There are unique circumstances behind each decision to stop out or transfer horizontally, and in many instances, it is unavoidable. A student may have to temporarily withdraw from school to care for an ailing family member, or an older student with a full-time job may get transferred to another city. However, in many instances, it can be avoided. The present research suggests that if the student has baccalaureate aspirations, they might benefit from additional structural supports that encourage them to stay continuously enrolled at their first institution or to help the student get back on-track as they re-enter or transfer.

A key role of academic advisors is to provide this type of support and a growing body of research suggests that meeting with an academic advisor is linked with positive academic outcomes (Bahr, 2008; Center for Community College Student Engagement, 2018; Chiteng Kot, 2014; Kolenovic, Linderman, & Karp, 2013; Young-Jones, Burt, Dixon, & Hawthorne, 2013). Although the link between advising and outcomes like engagement, GPA, and retention is growing, there is still very little research exploring the relationship between academic advising and vertical transfer or baccalaureate attainment among community college students. Lasota and Zumeta (2016) were among the first to explore this and found that meeting with an academic advisor was positively related to vertical transfer but was only marginally significant ($p < .10$). I similarly find that meeting with an academic advisor at least once in the first year of college had a statistically significant and positive relationship with vertical transfer and baccalaureate

attainment. The findings suggest that meeting with an advisor early in college may assist the student in navigating the community college system and vertically transfer, make major and course selection decisions, and avoid pitfalls like stopping out (Wyner et al., 2016). Additionally, the advisor can provide information and assistance on the requirements for transfer at various four-year institutions and what bureaucratic steps must be taken to ensure the transfer goes smoothly (Schudde, Jabbar, & Hartman, 2021).

There are a number of theories in education that center around student engagement, such as Astin's (1984) "Student Involvement Theory" or Tinto's (1975) "Theory of Student Departure." In general, the student's engagement level can be described as the extent to which the student has engaged academically, behaviorally, and cognitively with their coursework and with their institution (Fredericks, Blumenfeld, & Paris, 2004; Jimerson, Campos, & Greif, 2003). A sizeable body of research supports illustrates the role engagement behaviors play in predicting positive college outcomes, at four-year institutions and community colleges (Astin, 1993; Buckless & Krawczyk, 2016; Kuh, 2003; Kuh et al., 2008; Schudde, 2019). The findings of this analysis suggest a small *negative* relationship between engagement and vertical transfer, which seem to contrast with these engagement theories. There are a few possible reasons for this. In this analysis, I created a single engagement variable that included measures of social and academic integration. However, some extant research suggests that different aspects of engagement may varied relationships with academic outcomes. As one example, Schudde (2019) found that social and academic interactions with faculty were positively related academic outcomes, including vertical transfer, while other aspects of engagement, such as interactions with peers, bore no such relationship. It is possible this difference in how the engagement measures were constructed led to the differing results.

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Relationship between Institution-level Measures and College Outcomes

Figures 1 and 2 from this chapter also illustrate that two institutional-level measures predict vertical transfer and baccalaureate attainment: percent Pell recipients and local unemployment rate. Next, I describe how my findings compare with the prior literature.

Percent Pell Recipients

In this analysis, the percentage of students at the institution who received a federal Pell Grant. The results suggest that an institutions Pell receipt rate is inversely related with vertical transfer, but not baccalaureate attainment (where I observed a null relationship). There are few possible explanations for this. Nationally, two-year institutions are primarily funded through local and state funding, with a much larger percentage of the revenue coming from local sources than for four-year institutions (State Higher Education Executive Officers Commission, 2020b). Some states, like Kansas, obtain more funding from local entities than any other source (State Higher Education Executive Officers Commission, 2020a). As such, the funding levels of two-year institutions are much more affected by local economic conditions than four-year institutions. Much like public secondary schools, two-year institutions in more affluent communities will likely have more resources available to them than two-year institutions in less affluent neighborhoods. This analysis suggests that these differences in funding are reflected in differing vertical transfer rates, with students at less affluent schools (those with more Pell recipients) appearing less likely to transfer.

A second possible explanation is a contextual effect. The Pell grant status of a student is highly correlated with the SES score of a student. Students eligible for Pell grants often do not have the social capital or the network of relationships that can help students navigate unfamiliar

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environments like college settings (Prospero & Vohra-Gupta, 2007; Stanton-Salazar, 2001). As the number of Pell students increases, it may affect the characteristics of the institution itself.

Local Unemployment Rate

There is ample evidence that demonstrates fluctuations in economic conditions are related to changes in enrollment. For example, individuals are less likely to remain in school when the job market is favorable and more likely to stay in school when the job market is unfavorable (Johnson, 2015; U.S. Census Bureau, 2018). While it seems a natural outcome of this increased retention would be an increase in vertical transfer and baccalaureate attainment, the existing literature is not clear on this. Some research found that as employment conditions improved, the probability of vertical transfer decreased (Kienzl, Wesaw, & Kumar, 2011), although LaSota and Zumeta (2016) found no relationship. Like LaSota and Zumeta, I did not observe a relationship between the unemployment rate and vertical transfer. However, I did find that the local unemployment rate was positively related to baccalaureate attainment.

The link between local unemployment rate and baccalaureate attainment among community college entrants was not observed by Alfonso (2006), one of the few examples of prior research that captured this measure in statistical models. A possible explanation is that Alfonso (2006) used a sample of students who matriculated during a time in U.S. history experiencing favorable economic conditions across the country. The students in BPS 12/17 the analytic sample I used, drawn from the BPS 12/17, matriculated shortly after the Great Recession, which saw a substantial rise in home foreclosures and unemployment and a steep decrease in consumer spending. However, the Great Recession did not impact the United States uniformly, with some areas being hit quite hard, while others were only impacted modestly

(Sussman, 2019). This unevenness in the recovery may have generated variance in the

unemployment measure, perhaps allowing for easier detection of a relationship.

Institution-level relationships not Associated with College Outcomes

This study is one of the very few to explore how institution-level variables predict

vertical transfer and baccalaureate attainment of community college students in the hopes it

would provide guidance to community college leaders. None of the remaining variables –

revenues from the state, instructional expenses per student, the institution's net price, or student-

faculty ratio – demonstrated a relationship with either dependent variable. Revenue from the

state potentially influences multiple other factors at an institution. For example, when the state

reduces its contribution, it is often made up for through cost-cutting measures or increases

intuition. However, the findings suggest that revenues from the state do not predict either

vertical transfer or baccalaureate attainment. A variable potentially influenced by state funding

is student-to-faculty ratio, which also did not appear to significantly predict either vertical

transfer or baccalaureate attainment. These null results align with LaSota and Zumeta (2016),

who also did not identify a relationship between student-to-faculty ratio and vertical transfer, but

differ from Gross and Goldhaber's (2009) findings that a smaller student-to-faculty ratio was

associated with an increase in the probability of both vertical transfer and baccalaureate

attainment.

Although, some extant research has shown a relationship between instructional

expenditures per student and student outcomes (e.g., Pike et al., 2011; Griffith & Rask, 2016), I

did not observe a relationship between instructional expenditures per student and either vertical

transfer or baccalaureate attainment. This corroborates the findings of LaSota and Zumeta

(2016) and Stange (2012), who also found no association between instructional expenditures and

vertical transfer.   My null findings for net price align with Stern (2016), who also did not

identify an effect for the cost of tuition, though it is possible that this null finding is partially

driven by controlling for family socioeconomic status because students from lower SES families

would be more impacted by high tuition than students from high SES families.

Although the relationships for these variables were not significant in this analysis, the

results add to the growing body of research exploring the effect of institution-level variables on a

variety of student outcomes. A single study rarely provides definitive results for any

relationship. That is evident here as the literature illustrates mixed results for several of the

predictors of vertical transfer and degree attainment. Nevertheless, the null findings may be used

in future research synthesis or meta-analysis efforts that pull together the results of several

analyses and could potentially shine a brighter light on these relationships.

Relationship between State-Level Measures and College Outcomes

Research exploring whether broad statewide articulation and transfer policies improve

transfer rates has failed to clearly identify a link these policies and vertical transfer (Anderson,

Sun, & Alfonso, 2006; Brawer, 1995; Roksa and Keith, 2008; Roksa, 2009; LaSota and Zumeta,

2016). What most prior analyses have in common is they only looked at articulation and transfer

policies in the broad sense and did not investigate specific aspects within a statewide articulation

policy. LaSota and Zumeta (2016) incorporated this specificity and found in their main analysis

that a statewide articulation guide was positively associated with vertical transfer. This analysis

corroborates that finding as the presence of statewide articulation guides was associated with an

increased probability of vertical transfer.

The Education Commission of the States describe statewide articulation guides as

providing concrete descriptions of these requirements and attempts to answer questions students

may have regarding the transfer process (Smith, 2010). One example of an online transfer guide is provided by the State of Alabama (Alabama Articulation and General Studies Committee and Statewide Transfer and Articulation Reporting System, n.d.). It has a separate guide for students and for advisors, counselors, and administrators. The student guide walks students through the process of transferring from a two-year public institution to a four-year public institution, from a two-year public institution to a private institution, and other types of transfer, such as transferring across state lines, or transferring horizontally. If choosing to transfer from an in-state public community college to an in-state public four-year institution, the guide will recommend four-year institutions and provide the student's contact information to those institutions for recruiting purposes.

Once the student has entered their personal and major information, the next screen outlines the transfer guide and transfer agreement for that specific major approved by the Alabama Articulation and General Studies Committee. The guide provides information on what courses one should take, in what sequence they should be taken, and which four-year institutions in Alabama that will honor the contents of the guide. It also encourages students interested in transferring to meet with an advisor. This is a description of the guide is for 2021 and does not necessarily reflect how it was in 2011 when the BPS:11/17 study commenced. While many states had dedicated online transfer and articulation sites in 2010, some states only provided it in catalogs (Georgia, Idaho, Iowa) or provided specific copies of transfer and articulation guides at each institution (Utah) (Smith, 2010).

In addition to statewide articulation guides, cooperative agreements positively correlate with vertical transfer and baccalaureate attainment. States that reported at least one cooperative agreement between two-year and four-year institutions had vertical transfer rates significantly

higher than states with no such agreements. At the time of the study, most states had some sort

of cooperative agreement between institutions, with only Arkansas, Kentucky, South Carolina,

Tennessee, and Utah not having any such agreements.

Why might there be a positive relationship between cooperative agreements and vertical

transfer? To understand, it may be helpful to identify the challenge cooperative agreements can

potentially address. In qualitative interviews with transfer personnel and students at two Texas

community college districts in Texas, researchers found that university personnel tended to set

the rules and norms for credit transfer (Schudde, Jabbar, & Hartman, 2021). Given their role to

navigate transfer rules for each destination institution, due to little collaboration between the

public universities and community colleges, community college students were faced with

competing and confusing information. This complexity even affected community college staff

who were at times unsure if they had accurate information about transfer requirements.

Cooperative agreements may be effective in offering more transparent transfer pathways

between participating community colleges and their public university collaborators. As one

example, the community colleges and public four-year institutions in Washington state have

collaborated to create field specific transfer agreements called Direct Transfer Agreements

(Wyner et al., 2016). This customized transfer information on how to transfer into specific

majors at specific universities may improve the likelihood of transfer, even when a statewide

policy is present.

State-level Variables Not Associated with College Outcomes

The state-level variables of transfer data reporting, incentives and rewards, common-

course curriculum, and common-course numbering were not associated with either vertical

transfer or baccalaureate attainment. I offer additional context on the measures and prior literature for these measures below.

Transfer data reporting is useful to adequately monitor the success of transfer and articulation programs; the ECS tracked whether states reported information related to vertical transfer from 2000 until 2010 (Education Commission of the States, 2000). This analysis did not identify a relationship between transfer data reporting and vertical transfer or baccalaureate attainment. These findings corroborate those of LaSota and Zumeta (2016), the only other study—to my knowledge—that explored the effect of this variable on vertical transfer. Beginning with the 2020 state-by-state articulation and transfer report, ECS will no longer track this variable (Francies & Anderson, 2020).

To encourage vertical transfer, some states have offered incentives and rewards to entice students to transfer (Education Commission of the States, 2000). Some examples of these rewards are guaranteed transfer of credit, financial aid, or priority admission. This analysis did not identify a relationship between incentives and rewards, corroborating the findings of LaSota and Zumeta (2016). Beginning in 2020, ECS no longer tracks a variable called "incentives and rewards" but instead collects two individual variables that would have previously fallen under this category – guaranteed transfer of an associate degree and reverse transfer.

To streamline the articulation process and hopefully eliminate confusion, some states have instituted a common-core curriculum that standardizes the required core courses across institutions (Education Commission of the States, 2000). This analysis did not identify a significant relationship for common-core curriculum, which corroborates LaSota and Zumeta (2016). This variable is included in the 2020 ECS report (Francies & Anderson, 2020).

The final state-level variable examined is common-course numbering, which assigns the same course number to courses at different institutions that are the same (Education Commission of the States, 2000). This analysis did not identify a relationship between common-course numbering and either vertical transfer or baccalaureate attainment. In their analysis of all students included in the BPS:03/09 sample, LaSota and Zumeta (2016) identified a significant but *negative* effect for common-course numbering. However, when they refined their analysis to only include subpopulations with significant variation in slopes, they found that common-course numbering was positively related to the vertical transfer of first-generation and low-income students. In a supplemental analysis, I was unable to replicate this finding after sub-setting the sample by first-generation and low-income students (those with SES factor scores below the mean).

Implications for Policy and Practice

Community colleges serve a disproportionate number of first-generation college students, students from low-income families, and students of color (Schudde & Goldrick-Rab, 2016). Given the populations they serve, community colleges have the potential to serve as engines of social mobility. At the same time, the transfer system is complicated, and transfer policies and processes are difficult to navigate (Schudde, Jabbar, Epstein, & Yucel, 2021), making it hard for students to succeed in reaching their baccalaureate aspirations. Over the past few decades, administrators, lawmakers, and researchers endeavored to find ways to enhance the academic outcomes of community college students, including rates of transferring to a four-year institution and earning a baccalaureate. My research aimed to contribute to this effort and provide administrators and lawmakers with information to inform policy change that will maximize transfer success.

Information on How to Navigate the System

A key takeaway from this analysis appears to be that providing students with information on how to navigate the community college system and transfer to a four-year institution is positively related to vertically transferring and earning a baccalaureate. This information can be garnered by meeting with an advisor, providing the information in a readily available transfer and articulation guide, or both. For example, the student could meet with an advisor, who verbally describes the process and the steps the student should take, and the pitfalls they should avoid, then provides the student with an easy-to-read articulation and transfer reference guide that the student can take with them. Qualitative research suggests that transfer guides should include clear signals of transfer policies to make it transparent to students how courses with apply toward the desired degree and which transfer policies are in place to support the student (Schudde et al., 2021). Knowing what steps must be taken before beginning the journey will likely enhance the probability of success.

Cooperative Agreements

Another state-level variable in this analysis demonstrating a positive relationship with both vertical transfer and baccalaureate attainment is the presence of cooperative agreements. To reiterate, cooperative agreements are accords between at least one two-year institution and at least one four-year institution that are not mandated by the state and are intended to facilitate transfer and articulation. Although there is little evidence to date that suggests cooperative agreements are effective, 90% of the states had some sort of cooperative agreement in 2010, with only the states of Arkansas, Kentucky, Maine, South Carolina, and Tennessee indicating there were no cooperative agreements.

Cooperative agreements are different because they are typically negotiated directly between the two and four-year institutions and are not mandated by the state. A potential reason this variable yields a positive relationship is that both parties are genuinely motivated to improve the pathway from community college to a baccalaureate institution, and this motivation may lead to a more successful outcome. When the state mandates it, I am reminded of the axiom, "you can lead a horse to water, but you cannot make it drink." Perhaps not all institutions mandated to comply will be enthusiastic about it and resort to only the bare minimum.

While this result seems robust and is present for both vertical transfer and baccalaureate attainment, a note of caution should be attached to these findings. First, there is no prior empirical research that points to the effectiveness of cooperative agreements on vertical transfer or baccalaureate attainment. LaSota & Zumeta (2016) empirically evaluated cooperative agreements, but did not identify an effect. Second, the cooperative agreement data was self-reported by state agencies to ERC, and there are no assurances to the accuracy of the information provided. Third, upon visual inspection, it appears some programs reported as cooperative agreements between institutions may, in fact, be state-mandated policies for public institutions. This is not surprising, since institutions often must work together and create cooperative agreements in the presence of state mandates (Bailey, Jenkins, Fink, Cullinane, & Schudde, 2017). Finally, the variable is somewhat skewed, with only 10% of states with no cooperative agreements, which may distort the results.

Contributions

Despite these possible alternative explanations, a key contribution of this analysis is that it presents evidence that state-level variables may indeed play a role in vertical transfer or baccalaureate attainment. For example, cooperative agreements (although dichotomized and not

ideally constructed) had predictive power in this analysis. Improvements in the data combined with more informative descriptions of the policies could further aid researchers in exploring these relationships and how to best implement these policies.

A second contribution is the multi-level nature of this study. In addition to accounting for natural hierarchies in the data that could potentially distort the analysis, it allowed me to simultaneously identify relationships at different levels of analysis. This allowed for a more complete picture of how the variables at different levels of the analyses behaved while being measured simultaneously.

Limitations and Recommendations for Future Research

There are several hurdles researchers must clear when examining predictors of transfer outcomes among community college students, particularly for state-level variables. Perhaps the greatest challenge in assessing the effect of statewide policies is the construction and definition of appropriate state-level variables. Roksa (2009) noted that independent raters were unable in some instances even to identify the presence of a statewide articulation and transfer policy. LaSota and Zumeta (2016) noted similar challenges in their analysis. For example, in the data for this analysis, it was unclear if policies reported under "cooperative agreements" were actually state-level policies rather than agreements between individual institutions.

A second challenge in using data collected by the Education Commission of the States is that the data does not allow researchers to understand the degree of policy implementation. ECS compiles statewide data on multiple variables, but each measure is dichotomous, capturing a given policy as "present" or "not present." This binary style of reporting eliminates the ability to measure the degree of implementation. If multiple institutions within a state had comprehensive cooperative agreements, that would be a more robust implementation of the policy than in a state

with a single vague agreement between one two-year institution and one four-year institution. If a state instituted the policy that a guide on articulation and transfer would be provided to all incoming students and be available online in conspicuous places, that would be a more robust intervention than providing it only online in an obscure location.

A final challenge is determining the date of implementation. Even when the policy can be clearly identified, in some instances, it can be challenging to determine if the policy was present during the time the study was conducted. If a law or policy was passed before the commencement of a study, that does not necessarily mean the policy was implemented by the time the study began. As one example, LaSota and Zumeta (2016) used the BPS:03/09, where students first enrolled in Fall of 2003, however due to limitations with the articulation and transfer data, they could not always pin down the exact date of implementation, and occasionally had to estimate if a policy was implemented by the 2005-2006 academic year. This obviously enters error into the analysis, but given the nature of the data, the researchers had little to work with. Little could be done to avoid it. This analysis was fortunate because the students in the BPS:11/17 sample matriculated only months after the ECS December 2010 report was released, significantly reducing the need to approximate implementation dates.

A recommendation for future researchers in engaging in analyses of this type is to take steps to ensure the measures they use, particularly for state-level variables, accurately define the variable, its degree of implementation, and the date it was fully implemented at the institution. In addition to using from an aggregation source like ECS, researchers might review the source information—be it state laws, or policies, or reports on implementation—when it is available to create variables that more accurately reflect the policy it is trying to measure. As time passes

and more information becomes available online, ensuring data quality in this fashion should be less burdensome than in the past.

As more information on policies becomes available online, it may become possible for researchers to estimate the degree of implementation beyond a simple binary variable provided by an entity like ECS. This could entail setting up a set of benchmarks (e.g., no policy, less comprehensive policy, more comprehensive policy) and having two or more raters independently assign policies to these categories and then obtain a measure of inter-rater reliability at the conclusion.

A second recommendation would be to explore any differential impact these institution and state level variables may have on subgroups, including variation by race and ethnicity or first-generation status. This could be done through a number of ways. A straightforward way is sub-setting the data by groups of interest and running the analysis. However, an easier option could be to add one or more interaction terms.

Finally, while there are many advantages to using a multi-stage nationally representative sample for researching these questions, the nature of the data may limit the effectiveness of evaluating certain variables, particularly those at the institution and state level. In some cases, a pre-post time-series design within a state may be more informative when assessing a policy instituted by the state or an institution level. For example, if a state instituted a comprehensive articulation and transfer policy in 2010, the vertical transfer rates and baccalaureate attainment of students in the years before the implementation could be compared to the students who matriculated afterward. As all eligible students in the state could be included, the analysis would have substantially more statistical power than a survey that just draws a sample of those students. Additionally, as students could be compared within the same state and within the same

institutions, the internal validity of the analysis would be enhanced in addition to having more statistical power.

Final Thoughts

A core mission of the community college is to serve as a stepping-stone to a four-year institution and ultimately a baccalaureate degree. Over the past few decades, the gap in baccalaureate attainment between students who start at two-year institutions and students who start at four-year institutions has only widened (Schudde & Brown, 2019). To address this, it has become imperative for stakeholders to identify strategies for narrowing this gap and easing the pathway to a four-year degree for students who begin at a community college. It is my hope that the present study contributed to the growing body of literature supporting this endeavor and provide a platform that future research can be launched from.

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Appendix A

Plots of estimates of Empirical Bayes residuals to determine whether the dichotomous outcome

variable varied meaningfully across higher-level units of measurement (institution and state).

Figure A1

Empirical Bayes residuals of vertical transfer within institutions
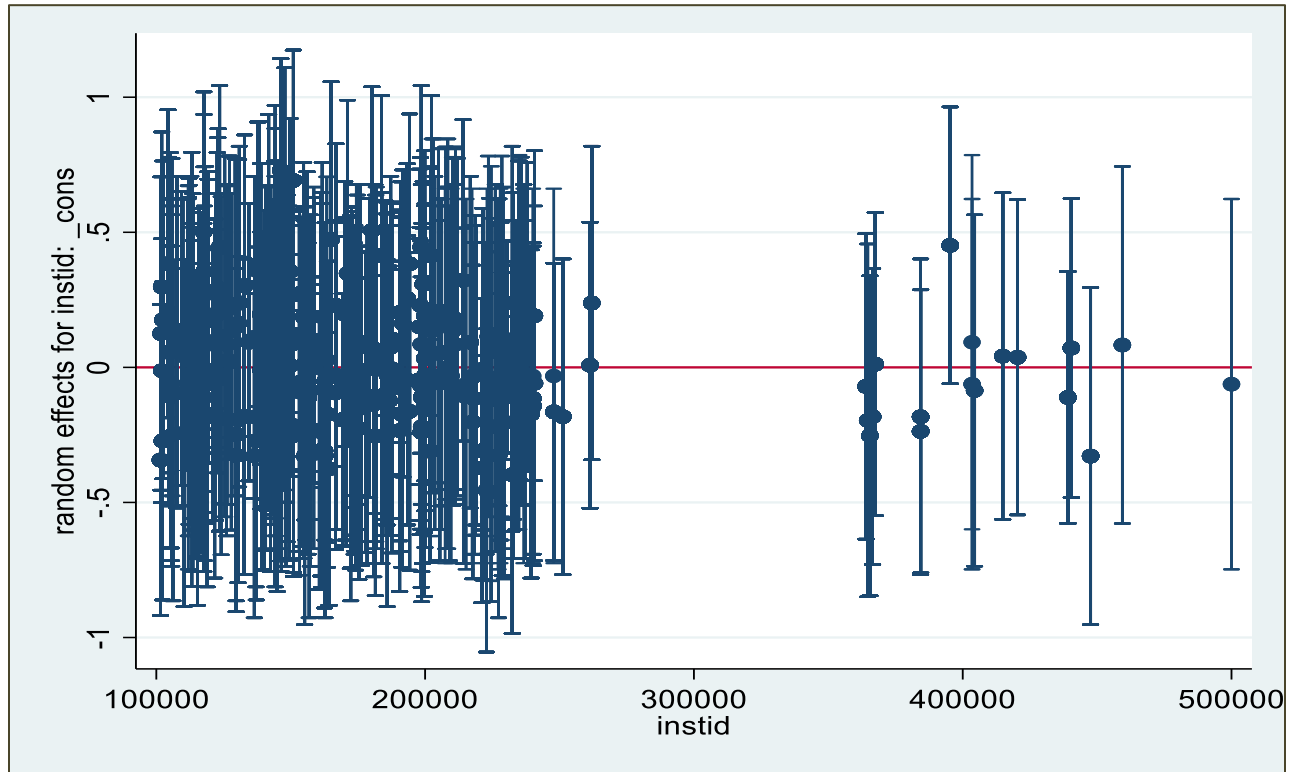
Note. This figure displays the distribution of Empirical Bayes residuals for vertical transfer within institutions. The vertical axis displays the residual plots and the horizontal axis displays the unique IPEDS institution code for each individual institution included in the analysis.
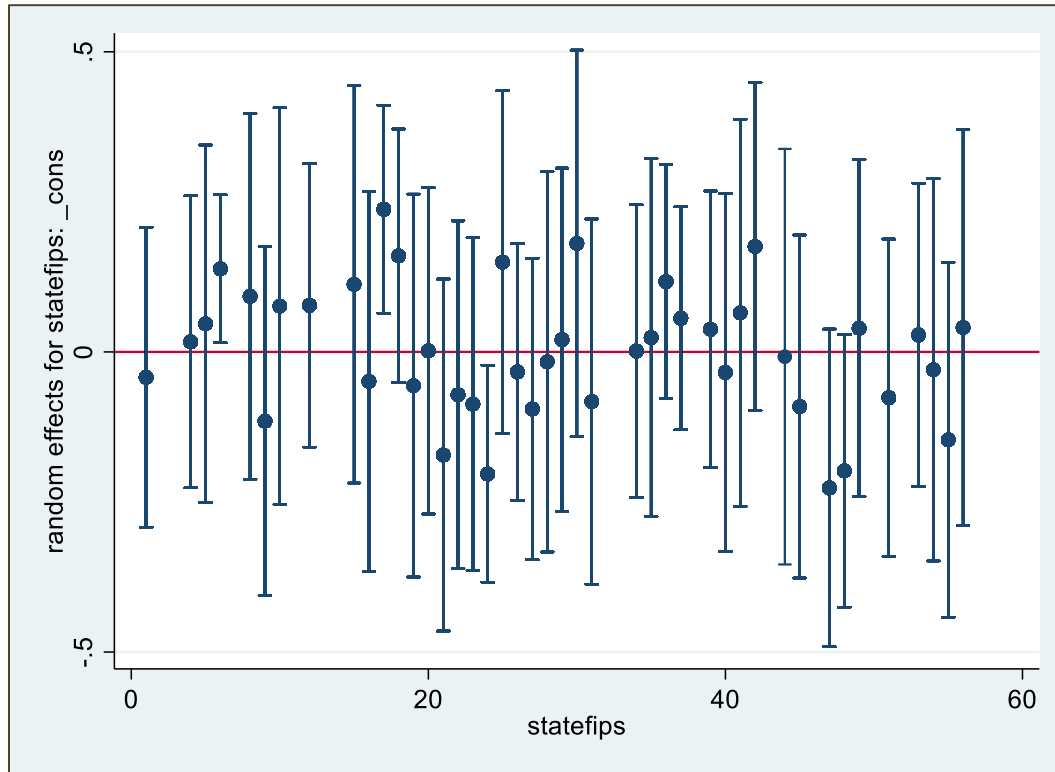
Figure A2

Empirical Bayes residuals of vertical transfer within states

Note. This figure displays the distribution of Empirical Bayes residuals for vertical transfer within states. The vertical axis displays the residual plots and the horizontal axis displays the Federal Information Processing (FIPS) code for each individual state included in the analysis.

Figure A3.

Empirical Bayes residuals of baccalaureate attainment within institutions

Note. This figure displays the distribution of Empirical Bayes residuals for baccalaureate attainment within institutions. The vertical axis displays the residual plots and the horizontal axis displays the unique IPEDS institution code for each individual institution included in the analysis
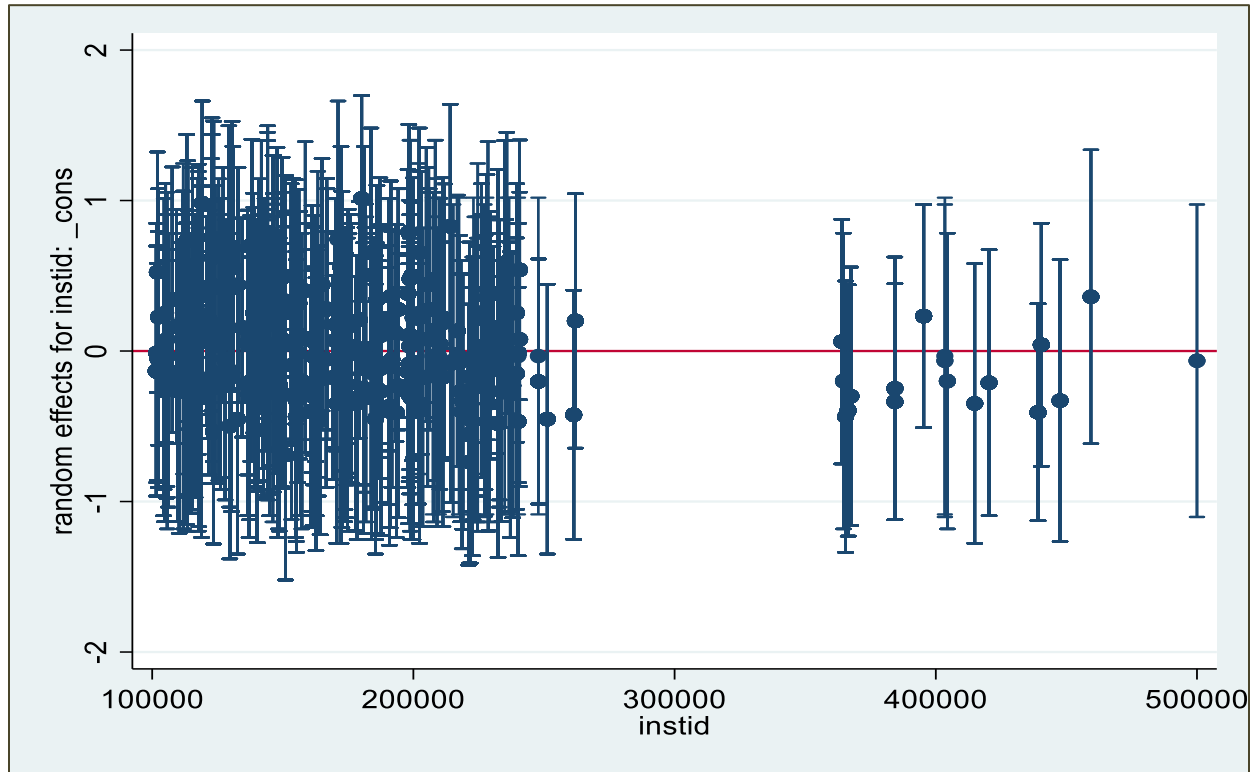
Figure A4

Empirical Bayes residuals of baccalaureate attainment within states

 Note. This figure displays the distribution of Empirical Bayes residuals for baccalaureate attainment within states. The vertical axis displays the residual plots and the horizontal axis displays the Federal Information Processing (FIPS) code for each individual state included in the analysis.
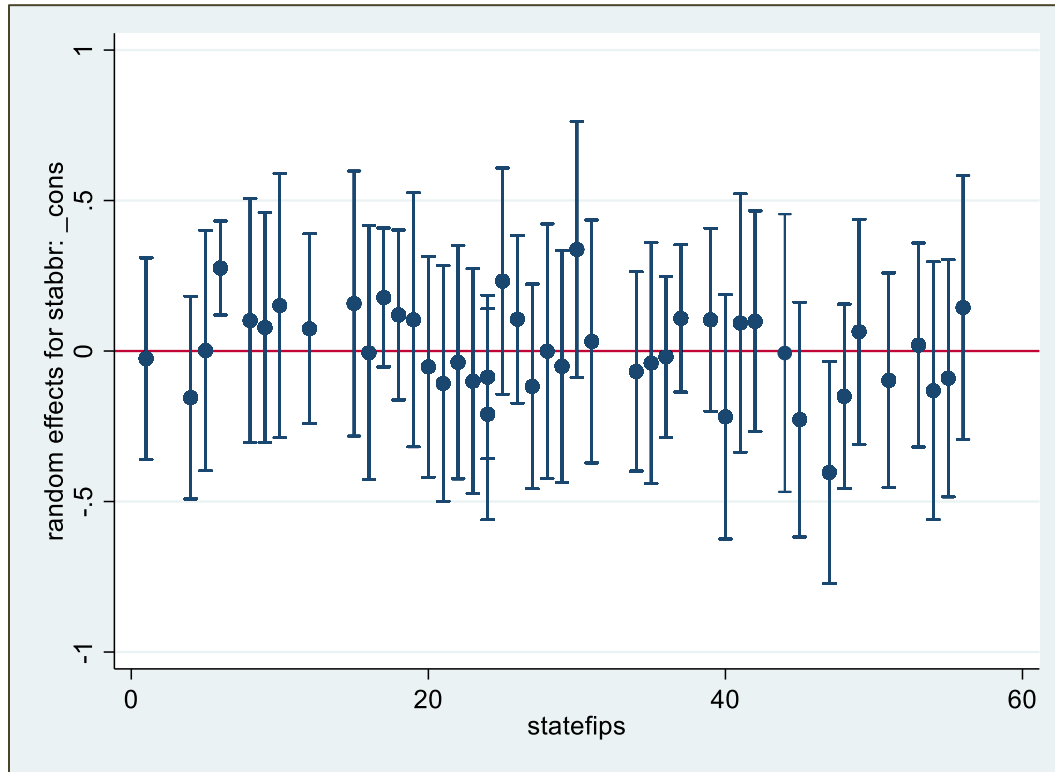
Appendix B

Results for factor analysis for the created variables of socioeconomic status and student engagement.

Table B1.

Factor Analysis on Student Socioeconomic Status

	M (*SD*)	Factor loadings
Factor: Socioeconomic status		
· Father's education	.652 (.909)	0.7922
· Mother's education	.719 (.879)	0.7802
· Family Income	.488 (0.458)	0.6609

Note: $N = 6{,}520$. To capture student socioeconomic status, we used father's education, mother's education, and logged family income. A factor loading of 0.4 or higher is generally regarded as the threshold for loading on a factor (Gorsuch, 2015). Here, all included variables meet that threshold.

Table B2

Factor Analysis on Student Engagement on Campus

	M (*SD*)	Factor loadings
Factor: Socioeconomic status		
· satisfaction with social experience in first year	4.301 (.901)	0.745
· belongingness (felt like part of institution) in first year	3.931 (1.125)	0.783
· interactions with faculty first year	4.331 (.931)	0.773
· Satisfaction with studies in first year	4.141 (1.033)	0.798

Note: N = 6,520. To capture student involvement on campus, we used measures of academic satisfaction, sense of belonging, interactions with faculty and satisfaction with studies in first year. A factor loading of 0.4 or higher is generally regarded as the threshold for loading on a factor (Gorsuch, 2015). Here, all included variables meet that threshold.

Appendix C.

This section includes correlation matrices for the variables on each level of an analysis and is intended to detect potential multicollinearity.

Appendix C1.

Intercorrelations among student-level variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Female	1.00														
2	Age	0.00	1.00													
3	Marital status	0.02	0.50	1.00												
4	Dependent status	-0.07	**-0.64**	-0.45	1.00											
5	Delayed enrollment	-0.01	**0.87**	0.46	**-0.57**	1.00										
6	Dependent children	0.13	0.49	0.41	**-0.67**	0.41	1.00									
7	SES	-0.08	-0.20	-0.07	0.28	-0.17	-0.21	1.00								
8	Financial gap	0.02	0.02	0.04	-0.14	-0.02	0.09	-0.12	1.00							
9	Faculty engagement	0.04	0.11	0.05	-0.08	0.09	0.06	-0.06	0.04	1.00						
10	Use acad advising	0.08	0.05	0.00	-0.03	0.05	0.01	0.07	-0.01	0.05	1.00					
11	Stopout	-0.01	-0.05	-0.01	0.01	-0.04	-0.03	-0.01	-0.03	-0.03	-0.05	1.00				
12	Horizontal xfer	0.08	-0.06	-0.04	0.05	-0.07	-0.02	0.00	0.02	-0.01	-0.01	-0.03	1.00			
13	Switched major	0.08	-0.04	-0.01	0.03	-0.03	-0.02	-0.01	0.05	0.02	0.05	0.04	0.01	1.00		
14	GPA	0.06	0.14	0.13	-0.12	0.13	0.07	0.05	0.02	0.18	0.08	-0.09	-0.11	0.04	1.00	
15	Bacc expectations	0.08	-0.13	-0.05	0.10	-0.13	-0.10	0.05	0.02	-0.01	0.08	0.01	0.04	0.06	0.03	1.00

Note. Potential multicollinear relationships are presented in bold. The variables age, dependent status, delayed enrollment, and dependent children are highly inter-correlated.

Appendix C2.

Intercorrelations among institution-level variables

	1	2	3	4	5
1. Revenues from state	-				
2. Instructional expenses	0.23	-			
3. Percent Pell	-0.06	-0.13	-		
4. Net price	-0.06	0.05	-0.09	-	
5. Unemployment rate	0.08	-0.21	0.24	-0.17	-

Appendix C3.

Intercorrelations among institution-level variables

	1	2	3	4	5	6	7
1. statewide policy	-						
2. cooperative agreements	0.04	-					
3. Transfer data reporting	-0.16	0.17	-				
4. Incentives and rewards	0.48	-0.1	**1**	-			
5. Statewide articulation guide	0.34	0.33	0.25	**0.6**	-		
6. common core	0.39	0.23	**0.79**	**0.74**	0.57	-	
7. Common course numbering	**0.69**	0.4	0.6	0.22	0.21	**0.81**	-

Note. As all state-level variables are dichotomous, tetrachoric correlation coefficients are reported. The variables of statewide policy and common course numbering are highly intercorrelated. Additionally, the variables of transfer data reporting, incentives and rewards, and common cure are highly interrelated.

Appendix D.

Results for State-level Variables Included Individually in Model Two for Vertical Transfer and

Baccalaureate Attainment.

Variable	AME	s.e.	
Vertical Transfer			
Cooperative agreements	0.074	0.029	**
transfer data reporting	-	-	
Incentives and rewards	-	-	
Statewide articulation guide	0.031	0.015	*
common core	-	-	
Common course numbering	-	-	
Baccalaureate Attainment			
Cooperative agreements	0.053	0.021	**
transfer data reporting	-	-	
Incentives and rewards	-	-	
Statewide articulation guide	-	-	
common core	-	-	
Common course numbering	-	-	

Note. Each variable was entered individually for both vertical transfer and baccalaureate attainment and the results were captured here. Entering the variables individually provided comparable results to including all of the variables at once.