The Four-Year College Pipeline And Factors Related To Bachelor’s Degree Completion For High School Graduates

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The Four-Year College Pipeline And Factors Related To Bachelor's Degree Completion For High School Graduates

Abstract
This study examines students' progress from high school graduation through college enrollment and completion. Much of the existing research frames high school dropout, college access, and college completion as separate phenomena; few studies examine individuals' transitions across these points. Thinking about these events as related pieces of a pathway to educational attainment is called an education pipeline perspective. This perspective is particularly useful today, given recent reforms aimed at improving high school academic achievement, preparing students for college and careers, and increasing educational attainment.

Using two nationally representative, longitudinal data sets (ELS:2002 and NELS:88) I examined changes in the education pipeline for high school seniors in the 2004 and 1992 cohorts. I also explored the relationship between bachelor's degree completion and high school academic achievement using logistic regression for students from the 2004 senior cohort who enrolled on-time in four-year institutions. The logistic regression results were used to conduct a path analysis modeling to what extent the experience of transferring from a four-year college mediates the relationship between bachelor's degree completion and academic achievement.

Findings from this study indicate that a greater percentage of the 2004 cohort enrolled in college compared to the previous cohort, but the increase was largely driven by students who delayed enrollment by six months or more. The six-year bachelor's degree completion rate of the 2004 cohort was also lower than that of the 1992 cohort. Additionally, students who transferred from four-year institutions tended to switch to public two-year institutions. Results from the regression analyses suggest that high school GPA was a stronger predictor of bachelor's completion than SAT score; however, SAT score better predicted transferring. Transferring was a significant, but weak mediator of the relationship between academic achievement and bachelor's degree completion.

This study's findings contribute to the understanding of student transitions along the education pipeline and to the literature on academic achievement, transfer, and bachelor's degree completion.

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THE FOUR-YEAR COLLEGE PIPELINE AND FACTORS RELATED TO BACHELOR’S DEGREE COMPLETION FOR HIGH SCHOOL GRADUATES

Michael Armijo

A DISSERTATION

in

Education

Presented to the Faculties of the University of Pennsylvania

in

Partial Fulfillment of the Requirements for the

Degree of Doctor of Philosophy

2014

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THE FOUR-YEAR COLLEGE PIPELINE AND FACTORS RELATED TO BACHELOR’S DEGREE COMPLETION FOR HIGH SCHOOL GRADUATES

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Michael Armijo
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ABSTRACT

THE FOUR-YEAR COLLEGE PIPELINE AND FACTORS RELATED TO BACHELOR’S DEGREE COMPLETION FOR HIGH SCHOOL GRADUATES

Michael Armijo
Rebecca Maynard

This study examines students’ progress from high school graduation through college enrollment and completion. Much of the existing research frames high school dropout, college access, and college completion as separate phenomena; few studies examine individuals’ transitions across these points. Thinking about these events as related pieces of a pathway to educational attainment is called an education pipeline perspective. This perspective is particularly useful today, given recent reforms aimed at improving high school academic achievement, preparing students for college and careers, and increasing educational attainment. Using two nationally representative, longitudinal data sets (ELS:2002 and NELS:88) I examined changes in the education pipeline for high school seniors in the 2004 and 1992 cohorts. I also explored the relationship between bachelor’s degree completion and high school academic achievement using logistic regression for students from the 2004 senior cohort who enrolled on-time in four-year institutions. The logistic regression results were used to conduct a path analysis modeling to what extent the experience of transferring from a four-year college mediates the relationship between bachelor’s degree completion and academic achievement. Findings from this study indicate that a greater percentage of the 2004 cohort enrolled in college compared to the previous cohort, but the increase was largely driven by students who delayed enrollment by six months or more. The six-year bachelor’s degree completion rate of the 2004 cohort was also lower than that of the 1992 cohort. Additionally, students who
transferred from four-year institutions tended to switch to public two-year institutions. Results from the regression analyses suggest that high school GPA was a stronger predictor of bachelor’s completion than SAT score; however, SAT score better predicted transferring. Transferring was a significant, but weak mediator of the relationship between academic achievement and bachelor’s degree completion. This study’s findings contribute to the understanding of student transitions along the education pipeline and to the literature on academic achievement, transfer, and bachelor’s degree completion.
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Chapter 1

INTRODUCTION

Higher education standards and achievement have economic, national security, and social implications. Increased levels of educational attainment are widely believed to be a requisite for improving the economic competitiveness of the nation (Schwab, 2013). The Council on Foreign Relations recently released a report suggesting low levels of educational attainment “puts the United States’ future economic prosperity, global position, and physical safety at risk” (Council on Foreign Relations, 2012, 4). Research shows that higher levels of educational attainment are correlated with other desirable outcomes including lower unemployment, higher income, more volunteerism, less criminality, as well as happier and healthier lifestyles (Aud, Wilkinson-Flicker, Kristapovich, Rathbun, Wang, & Zhang, 2013; Devereux & Fan, 2011; Brand, 2010; Dee, 2003; Haveman & Wolfe, 1984; Lochner, 2004; Oreopoulos & Salvanes, 2011; Oreopoulous, 2007). As a result, President Obama, the nation’s governors, and philanthropic organizations recently initiated a number of reforms with the goals of improving students’ college readiness and degree completion rates.

While these initiatives have resulted in efforts to improve degree attainment that focus on transitions between high school and college, very little of the research literature examines how students’ progress across key transition points. Researchers who study high school dropout, college access, and college completion typically frame these processes as separate phenomena. Thinking about these issues not as separate phenomena, but as related pieces of a pathway to educational attainment is called an education pipeline perspective (Ewell, Jones, & Kelly, 2003). The education pipeline perspective is gaining traction in education policy circles
and meshes with current reforms. With the adoption of the Common Core standards, much of the reform movement in K-12 is tied to preparing students to become college and career ready. This perspective has begun to foster meaningful discussion about the transition between high school, college, and the workforce in many states. These policy efforts have been termed “P20” or “K16.” Their goal is to encourage decision-makers from K-12 and higher education to communicate in order to improve educational attainment overall. However, much of the existing research on college completion focuses on all undergraduate students or first-time, full-time students, and not on recent high school graduates. Understanding how recent high school graduates transition across high school, progress through college, to graduation and beyond is the major purpose of the education pipeline perspective. Knowledge of the education pipeline is highly relevant to P20 policy initiatives. This dissertation contributes to the study of college completion by examining how recent high school graduates traverse the education pipeline and the factors related to their progression.

**Background**

The National Center for Higher Education Management Systems (NCHEMS) has been foundational in conceptualizing the education pipeline (Ewell, Jones, & Kelly, 2003; National Center for Public Policy and Higher Education, 2006). The education pipeline perspective spans K-12 and postsecondary education, and examines how students’ progress in educational attainment across key transition points. Most commonly student progress is measured from 9th grade across: (1) High school graduation within four years of entering high school, (2) enrollment in college immediately (i.e. the fall) after high school graduation, (3) first-year persistence in college, and (4) completion of an associates or a bachelor’s degree (Ewell, Jones, & Kelly, 2003). These transition points are useful for two reasons. First, they are the major
points where students tend to exit the pipeline. Second, they are points that state and localities can leverage through public policy. Nevertheless, viewing education through a pipeline perspective is fraught with challenges. One of the major challenges with studying the educational pipeline is that many states and the federal government do not track the progress of individual students across transition points between K-12 and postsecondary education. As a result, very few studies incorporate this lens to examine educational attainment.

The majority of studies about student persistence and degree completion incorporate theoretical perspectives that focus on students who are already enrolled in college. One branch of persistence and completion theories hypothesizes that student academic and social integration into the college community promotes bachelor’s degree completion (Astin, 1993; Bean, 1980; Bean & Metzner, 1985; Tinto, 1975, 1993; Cabrera, Nora, & Castaneda, 1993). These theories focus on the relationship between student background characteristics, student integration on a college campus, and an individual’s decision to persist and eventually graduate. Another conceptualization emphasizes the fit of an institution’s characteristics with student characteristics as the mechanism that affects persistence and completion (Spady, 1970; Meyer, 1970; Kamens, 1971; Tinto, 1993; Berge & Milem, 2000; Titus, 2006).

Of all the factors thought to be related to college completion, academic achievement and student background characteristics were most frequently examined in the literature. The most commonly used indicators of academic achievement are measures of GPA and standardized test scores, either alone or in combination. Theory proposes and research findings substantiate that student academic ability play a major role in bachelor’s degree completion (Bound et al., 2009; Schmitt, Keeney, Oswald, Pleskac, Billington, Sinha, & Zorzie, 2009; Davey &
Researchers have also studied the role student background characteristics. The most common measures employed are minority status, gender, SES, and educational aspirations. Although the theoretical literature suggests that these background factors should be related to degree completion, the research findings on their significance is mixed (Adelman, 2005; DesJardins, Kim, & Rzonca, 2003; Titus, 2006; Adelman, 1999, 2006; Cabrera, Burkum, & La Nasa, 2005).

In addition to academic achievement and student background characteristics, the type of experiences a student has during college may also be related to the likelihood of completing a degree (Bowe, Chingos, McPherson, & Tobin, 2009). In particular, attending college part-time, delaying enrollment, or transferring may affect a student’s college experiences. Part-time enrollment and delayed enrollment have been associated with lower odds of completion, whereas transferring from a two-year to a four-year institution has been show to increase the odds a student completes a degree (Bowen et al., 2009; Adelman, 1999, 2006). Transfer from a four-year institution has been relatively unexplored in the literature, except for Adelman (2006) who found that it is positively associated with earning a bachelor’s degree.

Student factors, however, do not affect completion in a vacuum. They occur in setting of the institution a student attends and the state in which the student lives. Institutions are the context in which the students’ academic experience unfolds. The institution a student attends has the potential to restrict or provide resources and opportunities. Researchers have found that institutional characteristics such as public/private control, undergraduate enrollment size, financial resources, and institutional social attributes may also be related to bachelor’s degree completion (Kamens, 1971; Gosman, Dandridge, Nettles, & Thoeny, 1983; Desrochers, Lenihan,
Others have found that the characteristics of a state’s postsecondary system may affect state bachelor’s degree production (Titus, 2009).

Only a few articles have been published using nationally representative data and an education pipeline perspective to study bachelor’s degree completion. Bound, Lovenheim, & Turner (2009) focused on high school graduates’ enrollment in and completion from four-year degree programs. Their work found that over the last several decades enrollment in four year degree programs increased, however degree completion rates for first-time students decreased. For the cohort of students graduating high school in 1972, 48% enrolled in college\(^1\). Of those who enrolled in college, 51% earned a bachelor’s within 8 years (Bound, Lovenheim, & Turner, 2009). However, the cohort of 1992 high school graduates earned bachelor’s degrees at a lower rate. Although 71% enrolled in college, just 46% of those who enrolled completed a bachelor’s within 8 years (Bound et al., 2009).\(^2\)

Adelman’s (2006, 1999) work examined how student background characteristics, high school achievement, and postsecondary attendance patterns were related to bachelor’s degree completion using nationally representative data (HS&B:80 and NELS:88). While his work did not specifically look at the transition points between high school and college, Adelman (2006, 1999) studied the factors related to student persistence to the second year of college and bachelor’s degree attainment. Overall, he found that higher academic achievement in high school leads to higher odds of earning a degree, as well as that transferring multiple times was negatively related to bachelor’s completion.

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\(^1\) Data are from NCES studies NLS:72 and NELS:88.

\(^2\) During this time the total number of first-time, full-time degree recipients per year increased by 156,000 (672,000 versus 828,000) due to the increasing enrollment rate.
This dissertation explores the education pipeline and the effects of student, institutional, and state factors on bachelor’s degree completion. In this study, I examine how two cohorts of students from the 1990s and 2000s progress from high school through college. I then examine the factors related to bachelor’s degree completion through logistic regression and path analyses. My work extends the work of Adelman’s (2006) and Bound, Lovenheim and Turner’s (2009) studies by looking at the pipeline using the most recent national data and comparing it with the previous cohort. I use the most recent nationally representative data available from the 2004 cohort of high school seniors to analyze the relationships between bachelor’s degree completion and academic achievement in high school, student background, college experiences, institutional characteristics and state characteristics.

Objectives

This study has the following three objectives:

1. Examine if the education pipeline leading to bachelor’s degree completion has changed over time, if the characteristics of students enrolling on-time in a four-year institutions have changed, and if students’ characteristics differ by college experience;

2. Explore the relationship between bachelor’s degree completion and high school academic achievement after accounting for student experiences in college, student, institutional, and state characteristics using the most recent data; and

3. Examine to what extent the college experiences of transfer and part-time enrollment mediate bachelor’s degree completion/high school academic achievement relationship.
This study uses restricted-use data from two National Center for Education Statistics (NCES) longitudinal studies: 1) the National Education Longitudinal Study of 1988 (NELS:88), and 2) the Education Longitudinal Study of 2002 (ELS:2002). Each study administered questionnaires to students and their teachers, parents, and school administrators to collect detailed data. The student questionnaires collected data on the following topics: School, work, and home experiences; educational resources and support; the educational role of parents and peers; educational and job aspirations; extra-curricular activities; and student perceptions. I link the NCES student-level data to college-level data in the Integrated Postsecondary Education Data System (IPEDS).

To accomplish the research objectives, I first use descriptive analyses to examine changes in the college pipeline as high school graduates enroll in college and proceed through bachelor’s degree completion. I also examine differences in student characteristics depending on the college experience at the first institution a student attended: full-time enrollment at only one four-year institution, transferring from a four-year institution to a four-year or two-year college, part-time enrollment at a four-year institution, and part-time enrollment and transferring. Second, I model the relationship between academic achievement and bachelor’s degree completion controlling for student, college, and state characteristics using logistic regression. I use the results of the logistic regression analyses to examine if transferring mediates the relationship between high school academic achievement and bachelor’s degree completion.

By using the most recent data and taking an educational pipeline perspective, this dissertation contributes to the literature on educational transitions and college completion. An
exploration of the role high school academic achievement and transfer from four-year institutions also contributes to the existing literature on transferring and bachelor’s degree completion, which tends to focus on the two-year to four-year aspect of transfer. The findings of this study have the potential to inform policy levers at the institutional level for student in their first semester, as well as those that transfer from a four-year institution. State leaders may find the education pipeline perspective particularly useful as it allows for the comparison of student progress patterns with other states and national averages. Many states may have similar results at the end of the pipeline, but students may be lost at different transition points along the way. Education pipeline data identifies these disparities and can be useful when identifying interventions to address educational challenges. This study will provide a national baseline that can be used for state-level comparisons.

**Limitations**

This study has three main limitations. First, the education pipeline perspective I am employing focuses on students who enrolled in a four-year institution on-time\(^3\), a group which makes up over two-thirds of all high school graduates that enroll in college. While most studies of the education pipeline begin with students in the 9\(^{th}\) grade, this study is limited to examining high school seniors. The study design also excludes students that do not graduate from high school on-time, drop out, or earn a GED. It also excludes those students who delay entry into college, as well as those who transfer from two-year to four-year institutions, those who leave college and return later, and adults, which limits the generalizability of the findings. Second, NCES studies were not designed to representative of states, so state-level analyses are not

\(^3\) On-time enrollment is defined as enrolling in college within six months of high school graduation.
possible. Finally, this study does not take into account other educational attainment outcomes, such as certificate or associate degree completion, persistence, or college credits earned.

**Organization of the Dissertation**

In this introductory chapter, I provided background on the educational pipeline perspective, predictors of bachelor’s degree completion, posed three objectives for the study, and outlined the study’s limitations. Chapter II reviews the previous research on the relationships between student, institutional, and state variables and bachelor’s degree completion in greater detail. The design for this study is detailed in Chapter III through a discussion of the data collected by the NCES studies and the methods I use to analyze them. It also reviews the models and the variables used in each analysis. Chapter IV reports the findings from the descriptive analyses of the education pipeline across the three cohorts, as well as findings from the logistic regression analyses and path analysis using the ELS:2002. The concluding chapter, Chapter V, summarizes the study’s findings and provides possible implications for research and policy.
Chapter 2

LITERATURE REVIEW

Existing research examines dozens of factors that are hypothesized to influence student retention and bachelor’s degree completion. This chapter reviews the major theoretical frameworks and empirical research on student, institutional, and state factors related to bachelor’s degree completion that guided this study. It reviews completion predictors in general. While the majority of studies focus on one point in time, it also attends to the emerging literatures that study the educational pipeline and historical trends in completion predictors. At the end of the literature review, I provide a brief overview of education policies that may have affected high school graduation, college enrollment, and degree completion. These policy shifts may be related to changes in the observed relationships between the outcome and independent variables over time.

Theoretical Perspectives on College Student Outcomes

The theoretical models that inform this study can be divided into two camps: Interactionism and organizational. Interactionism is a theoretical perspective that investigates how social processes, such as college persistence and completion, originate from human interaction in everyday life. For example, one piece of the college completion process stems from a student’s interactions with faculty and peers within the organization of the college. Organizational theory is the study of formal social organizations⁴, such as colleges and universities, and the behavior of actors that are part of the organizational environment. For instance, the rationale and rules guiding how college administrators can use financial resources

⁴ An organization is a social unit of people that is structured and managed to pursue a collective goal (Daft & Armstrong, 2009).
demonstrates organizational behavior at an institution. Combining the interactionist and organizational perspectives allows for a more comprehensive understanding how student behavior and organizational action at a college affect the completion process.

**Interactionist**

Much of the research on student persistence and degree completion draws on interactionist frameworks that emphasize the role of social and academic interactions on students’ college experiences. Early work in this area recognized that decisions to drop out were related to student psychological, familial, social, and economic issues. This work suggested that motivation, academic ability, attitudes and satisfaction were not immutable; these factors could be manipulated in a way to reduce student attrition (Summerskill, 1962). Summerskill’s (1962) use of psychological and sociological theories to identify and explain the student characteristics in retention formed the basis for subsequent theoretical models of student retention by Spady (1970), Tinto (1987, 1993), and others.

Spady (1970) and Tinto (1987, 1993) applied aspects of Durkheim’s theory of social integration to higher education. They claimed that students who were more socially integrated in the academic and social communities of the college were more likely to persist and graduate. Varying degrees of integration result from the interaction between the student and the college’s academic and social systems. Their works also suggested that an interdisciplinary and longitudinal approach to studying student retention would provide the most nuanced understanding of why students drop out. The student/college interaction approach was further developed to identify specific factors affecting integration, such as involvement, intentions, habits, values, expectations, residence, and employment (Astin, 1993; Tinto, 1987; Myer, 1970; Spady, 1970). Interactionist models also incorporated organizational concepts such school
values, support services, control, and student body composition, but did so in a way that made them more suitable for single-institution analysis (Summerskill, 1970; Myer, 1970; Astin 1993; Tinto, 1987).

**Organizational**

Organizational-level variables were first included in models of student outcomes in order to account for the effects of socialization conditions across colleges. For instance, Myer (1970) argued that institutional values at a college had the ability to influence the personal values, personality, and social roles of students. Kamens (1971) expanded on Myer’s (1970) insights, by studying the effects of institutional size and prestige on student outcomes. According to Kamens (1971), larger schools have less potential for inducing change in students as a result of less interaction between the student and organization. Prestige indicated the social importance of college membership and resulted in stronger student commitment.

Researchers continued to study the influence of organizational behavior on student attrition, borrowing from more general theories of employee attrition. Bean (1980) created a path model of student attrition that incorporated ideas about organizational turnover (Price, 1977), suggesting that the reasons employees turned over were similar to those that caused students to leave college. Student retention, he proposed, could be influenced by organizational characteristics such as peer group, faculty composition, availability of activities, and student support services. Furthermore, Bean (1980) argued that “not all student attrition is bad,” pointing out that turnover could be a result of students finding more suitable pathways to achieve their goals (p. 157). Gender also seemed to play a role in the process of leaving college, as his findings indicated that men and women drop out for different reasons. Bean’s model,
however, had its limitations. It excluded organizational characteristics like size or sector, and was designed primarily for use at single institutions.

More recently, Berger and Milem (2000) extended the organizational perspective from a single postsecondary institution to many. Their conceptual model allows for the study of students’ college experiences and outcomes across multiple institutions. The model takes individual-level student characteristics into account, and builds on previous work by dividing college-level characteristics into structural and behavioral components. Structural components include enrollment size, selectivity, control, and peer climate. Behavioral components include bureaucratic, collegial, political, symbolic, and systemic components. The authors suggest that college characteristics should be included with student characteristics in models that predict students’ college experiences and completion.

**Factors Related to College Completion**

In this section, I review the literature about the student and institutional variables that have relationships to bachelor’s degree completion. I have divided student variables into five different areas. Events students undergo in college are called college experiences. Student academic achievement is composed of high school GPA and standardized test scores. Gender, minority status, SES, and educational aspirations compose student background characteristics. Institutional characteristics cover public/private control, total enrollment, financial expenditures, and measures of the campus social environment. Finally, state characteristics I take into account are the proportions of postsecondary enrollment in two-year and in private institutions.
**College Experiences**

Researchers have studied the kinds of experiences a student has on a college campus and found that they are likely to affect the student’s satisfaction, learning, persistence, and completion. The college experiences of students are major components of both interactionist and organizational theories of persistence and completion. These theories hypothesize that students integration into the college social and academic communities varies as along with the kinds of experiences students have in college. Although there are many different college experiences that may matter for persistence and completion, this section focuses on three areas where research has already been conducted: Transfer, full-time/part-time enrollment intensity, and delaying enrollment into college.

**Transfer**

Transfer is traditionally defined as beginning college at a two-year institution, followed by a permanent move to a four-year institution with the intent of completing a bachelor’s degree (Dougherty & Kienzl, 2006; Bradburn & Hurst, 2001). This definition stems from the fact that transfer is an essential component of most two-year colleges’ missions, a sector which enrolled 49% of all first-time students between 1972 and 2005. Scholars and policymakers typically use the traditional definition of transfer across levels as an indicator of student success and institutional effectiveness for two-year colleges.

In addition to transferring from a two-year to a four-year institution, students may transfer between institutions of the same level, from a four-year institution to another four-year institution, or from a four-year institution to a two-year institution. The phenomena of transferring between institutions of the same level or from a four-year to a two-year level have
not been studied as closely as transfer across levels. Just one study (Adelman, 2006) examined the effects of transfer on students moving between four-year institutions. He found that transferring multiple times, a phenomenon known as swirling, had a significant negative relationship with earning a bachelor’s degree.

Transfer students are most likely to be freshman or sophomores, as well as minorities, low-income, first-generation, less academically prepared, and enrolled full time (Bowen et al., 2009; Dougherty & Kienzl, 2006). Among students who began at a two-year institution, 43% transferred (U.S. Department of Education, 1997). Twenty-eight percent of students who began at four-year institutions also transfer, and 12% of all undergraduates transferred more than three times (U.S. Department of Education, 1997).

Research indicates that students who transfer from a two-year to a four-year institution are more likely to complete a bachelor’s degree than those who do not. Bowen et al. (2009) conducted a propensity matching analysis on students in North Carolina and found that, compared to equivalent freshman, transfer students were much more likely to graduate. Adelman’s (2006) study also supported the conclusion that two-year to four-year transfer is positively associated with degree completion. The completion advantage that transfer students enjoy depends on the selectivity of the receiving institution. Transfer students at the most selective universities graduated at about the same rate as first-time freshman, however, at less selective institutions, transfer students graduated at higher rates than first-time freshman. The adjusted difference in graduation rates between transfer students and similar freshman, according to Bowen et al. (2009), is potentially due to selection effects that reflect unobserved differences in aspirations, maturity, social capital and coping skills. These factors have helped
transfer students successfully manage the transition from high school to their first college experience, and they will continue to contribute to subsequent success.

**Full-Time/Part-Time Enrollment Intensity**

The enrollment intensity of a student is typically defined as part-time if the student self-reports part-time enrollment or if a transcript examination reveals that the student ever enrolled in less than 12 credits for a semester (Adelman, 2006). Part-time students make up approximately 35% of all undergraduate students, but most of those students are not recent high school completers. Young (18-19 year old) part-time students make up about 3% of all undergraduate students. Even though they make up a small proportion of the undergraduate enrollment, the young, part-time student enrollment is increasing. The total fall enrollment of part-time students between 18 and 19 years old in degree-granting institutions increased by 87% between 1980 and 2010 (Snyder & Dillow, 2012).

Besides knowing how many young part-time students are enrolled in college, our knowledge about this group of students is relatively limited. For example, the federal IPEDS data system does not include graduation rates for part-time students. This omission from IPEDS is due to the fact that colleges are only required to count first-time, full-time students when reporting graduation rates. Unfortunately, only a few of the reports from longitudinal studies of college students, such as the Beginning Postsecondary Education Study (BPS) or the National Postsecondary Student Aid Study (NPSAS), disaggregate the data on part-time students by age or recent high school completion (Stratton, O’Toole, & Wetzel, 2006; Chen, 2007; Radford, Berkner, Wheeless, & Shepherd, 2010). Most of the information on young adult part-time students comes from the HSLS data and reports that examined the recent high school completers who attended college part-time (Hearn, 1992, Adelman, 2006, Carroll, 1989).
These studies found that, compared to full-time students, part-time students were less able to afford college, be academically prepared for college, or complete college once they have begun. Hearn (1992) found that part-time status was associated with a lower family SES, test scores, high school GPA, and educational aspirations. Part-time students were also considerably less likely to complete a bachelor’s degree than full-time students. Adelman (2006) found that part-time status reduces the probability a student earns a bachelor’s degree by over 35%. Using data on part-time students of all ages, both Stratton et al. (2006) and Taniguchi and Kaufman (2005), found that part-time students are less likely to graduate than full-time students, after controlling for financial assistance, parental education, delayed enrollment, and academic ability.

Part-time may have lower completion rates for three reasons. The first reason part-time students have lower chances of obtaining a bachelor’s degree is that accumulating the credits needed to earn a degree takes longer. Generally, as the duration of enrollment is extended, life events such as jobs, relationships, children, and living expenses can interrupt educational progress. Additionally, part-time students may also have more limited interactions with instructors and peers, which may reduce their integration into the institution’s social and academic structure, and ultimately the desire to persist and earn a degree. Finally, part-time students are typically not eligible for the same types and amounts of financial aid, either grants or loans, as full-time students. These restrictions can limit types of higher education institutions they can attend, as well as their ability to consistently pay for tuition, fees, and books.

**Delayed Enrollment**

High school graduates who are interested in attending college most commonly enroll in postsecondary education within a couple of months of high school graduation. However, many
students choose to delay enrollment in college for a variety of reasons. Students who delay entry into college are likely to do so for reasons such as military service, employment, family reasons, travel, or volunteerism. Delayed enrollment is typically defined as enrolling in college seven months or more after high school graduation (Bozick & DeLuca, 2005). Delaying enrollment by at least seven months would place a student one semester behind on-time enrollees. For the cohort of 1992 high school graduates, 17% did not enroll in college, 67% enrolled on-time, and 16% delayed enrollment in postsecondary education by seven months or more (Bozick & DeLuca, 2005).

Students who delay entry into college had different characteristics than on-time enrollees. Delayed enrollees were more likely to have lower academic preparation and lower income than students who enroll on-time. Delayed entrants were more likely to be first-generation college students, single parents, and minorities (Horn, Cataldi, & Sikora, 2005; Hearn, 1992). When delayed entrants enroll in postsecondary education, they were more likely to attend two-year colleges and private for-profit institutions. Once enrolled in postsecondary education, delayed entrants tended to enroll in programs that are vocational in nature and that lead to certificates or associate’s degrees (Horn et al., 2005). Still, the majority of delayed entrants (57%) aspired to earning a bachelor’s degree or higher (Horn et al., 2005).

Delaying enrollment in college after high school graduation is associated with a smaller chance of earning a bachelor’s degree. Two studies have examined the relationship between delayed enrollment and bachelor’s degree completion for recent high school graduates. Bozick and DeLuca’s (2005) study using data from the NELS:88 suggested that delaying enrollment reduced the odds of completion by 64%, after controlling for student background characteristics. Adelman’s (2006) work, also using NELS:88, found that students who enter
college immediately after high school graduation have 21% higher probability of bachelor’s degree attainment compared to those that delay entry. Other researchers have also found that students who delay enrollment are more likely to stop out or dropout, compared to those students that do not delay entry (Stratton, O’Toole, & Wetzel, 2005; Hearn, 1992). These studies, however, use data from the Beginning Postsecondary Education study which samples all first-time college entrants and therefore may not be representative of recent high school graduates.

**Academic Achievement**

Sufficient academic preparation for college is one of the most critical components students need in order to graduate in a timely fashion. Both interactionist and organizational theoretical perspectives identify student GPA and test scores as important indicators of academic preparation (Tinto, 1993, Berger & Milem, 2000). These models suggest that prior achievement is an indicator of a student’s future ability to integrate into and succeed in the college academic environment (Astin, 1993; Bean, 1980; Tinto, 1993; DesJardins et al., 2003). High school GPA and standardized test scores are the primary indicators of incoming students’ academic skills and cognitive ability. In addition, being able to immediately enroll in credit-bearing coursework or being required to take a remedial English or remedial math class is also indicative of a student’s academic resources. Numerous studies have examined the use of high school GPA and test scores as predictors of college-related outcomes such as enrollment, retention, credits earned, grades, and completion.
**High School GPA**

Several studies have shown that better academically prepared students are more likely to graduate (Bowen et al. 2009, Geiser, 2007; Adelman, 2006; Burton & Ramist, 2001). Both college admissions offices and researchers typically use GPA as a proxy for a variety of qualities related to completing a college program, such as cognitive ability, course content mastery, quality of effort, perseverance, time management, and study habits (Bowen et al., 2009, Adelman, 2006). But, it is unclear to what extent GPA reliably measures any of these qualities. Nevertheless, research has indicated a consistently positively association between high school GPA and six-year graduation rates, regardless of a student’s major (Geiser, 2007; Bowen et al., 2009; Bowen & Bok, 1998; Astin, 1993). This body of research also demonstrated that high school GPA retained its predictive ability even after controlling for standardized test scores and student background characteristics.

Even though studies of bachelor’s degree completion commonly use GPA, some researchers have raised concerns about the ability of high school GPA to predict college outcomes. Researchers have cited differences in grading standards across schools and grade inflation over time as potential measurement issues with student GPA. Grade inflation could cause measurement problems because as more students earn a high GPA the utility of GPA in predicting outcomes can be reduced (Camara, 2005). The lack of consistent grading standards within and across schools was another reason that the importance of high school GPA was downplayed. However, Bowen et al.’s (2009) study refuted these concerns, by demonstrating that GPA remains positively and consistently associated with six-year graduation rates regardless of the quality of high school a student attended. In studies using large samples of public institutions, the predictive validity of GPA also did not appear to vary across race, gender,
or SES subgroups (Bowen et al., 2009; Bowen & Bok, 1998; Flemming, 2002; Zheng, Saunders, Shelley, & Whalen, 2002).

**Standardized Test Scores**

Despite being designed to predict first-year college grades, researchers have used standardized tests such as the ACT and SAT to predict college graduation (Bowen et al., 2009; Bowen & Bok, 1998; Astin & Oseguera, 2012; Astin, 1993; Hoffman & Lowitzki, 2006; Geiser, 2007; Burton & Ramist, 2001). Statistical models typically included standardized tests as measures of aptitude or ability because the tests provide a standard of comparison across a national sample of students with different educational experiences. To use both the ACT and SAT in the same model, researchers typically transformed ACT scores to equivalent SAT scores using a concordance table (ACT, 2011). Research has shown that an increase in standardized test scores was positively related to a student’s odds of completing. Predictive validity studies indicated that SAT/ACT scores were less predictive of college outcomes than was high school GPA (Camara & Echternacht, 2000; Bowen et al., 2009; Geiser, 2007). However, models combining GPA and standardized test scores had significantly better predictive ability than using either variable alone (Geiser, 2007; Camara & Echternacht, 2000).

Several scholars contend that the association between standardized tests and college outcomes did not stem from the tests’ measurement of cognitive ability, but rather from associations with student background characteristics. Race and SES were shown to be more highly correlated with SAT scores than with high school grades. Bowen and Bok (1998) found that the predictive power of the SAT was reduced when student GPA, race, and SES are held constant. The relationship between SAT and college graduation disappeared altogether when high school dummy variables are introduced (Bowen et al., 2009). Using data from applicants to
the University of California, Rothstein (2004) also demonstrated that the ability of a student’s SAT/ACT score to predict college outcomes was reduced if the statistical model included the average SAT/ACT score from the student’s high school. From these results, Rothstein (2004) and Bowen et al. (2009) inferred that standardized test scores were, at least in part, crude measures of high school quality.

A growing body of research examines if the relationship between SAT/ACT score and graduation varies by racial group (Flemming & Garcia, 1998; Flemming 2002; Hoffman & Lowitzki, 2005; Wilson, 1980). Using data from over one thousand freshman at 15 different colleges, Flemming (2002) found that the predictive validity of the SAT/ACT varied by race and gender. Predictive validity was best for black men in predominately black colleges, worst for black men in predominately white colleges, and no different for black women in either predominately black or white college. These results suggested that the association between college outcomes and standardized test scores may depend on gender and college characteristics. Hoffman and Lowitzki (2006) also found that test scores were weaker predictors of academic achievement for racial and religious minorities than for whites.

**Student Background Characteristics**

**Gender**

Among college students, women are more likely than men to earn a bachelor’s degree. Until the early 1980s, women lagged behind men in college graduation rates and total number of bachelor’s degrees received (Bailey & Dynarski, 2011; Buchman & DiPrete, 2006). Since 1982, both the graduation rate and share of bachelor’s degrees awarded to women have grown. Most recently, the six-year graduation rate among first-time, full-time undergraduate students who
began seeking a bachelor’s degree at a four-year institution in fall 2005 was 56% for men and 61% for women (U.S. Department of Education, 2013). Additionally, women received 57% of all bachelor’s degrees awarded in 2011 (U.S. Department of Education, 2012).

The female advantage in graduation rates and bachelor’s degree production are part of a long term historical pattern in educational attainment for women. Since the 1940s, women have been more likely than men to complete high school and, beginning in the 1960s, women have been more likely than men to enroll in college (Bailey & Dynarski, 2011). Furthermore, not only were women more likely to graduate than men, but they were also more likely to graduate in less time. This result could potentially be due to the fact that women are more likely than men to attend college full time (Peter & Horn, 2005).

The female advantage in college completion currently exists for all racial groups, but gaps for each group appeared at different points in time. Among blacks, women have been more likely to graduate than men since 1915, while among whites and Hispanics graduation rates for women surpassed men in the 1960s (Bailey & Dynarski, 2011). As a result, women earned the majority of bachelor’s degrees. Black women earned two-thirds of all bachelor’s degrees awarded to black students, white women earned 59% of all bachelor’s degrees awarded to white students, and Hispanic women earned over 60% of all bachelor’s degrees awarded to Hispanic students (Peter & Horn, 2005).

Accounting for differences between men and women in academic preparation, family characteristics, and institutional selectivity reduces, but does not eliminate, the male/female gaps in graduation rates. Women were more likely to have better grades and take more advanced math classes than men (Peter & Horn, 2005). But, Bowen et al. (2009) show that once differences in academic preparation were accounted for, the gaps between male and female
graduation rates shrunk, but did not disappear. Attainment also depended on family income. Men and women from high income families were more likely to earn graduate than men and women from low-income families. However, the attainment gap between women and men from high income families was larger than the gender gap from low-income families. Women also remained more likely than men to earn a bachelor’s degree after controlling for institutional selectivity and family SES (Bowen et al., 2009; Bailey & Dynarski, 2011).

The association between gender and completion is also moderated by father’s education level. Buchman and DiPrete (2006), using data from the General Social Survey and NELS:88, found that father’s education matters more for men than women and that this relationship remained despite controls for student and institutional characteristics. Among those who enrolled in four-year colleges, men with lower levels of father’s education (including father absence) were much less likely than similar women to earn a bachelor’s degree. Buchman and DiPrete (2006) hypothesize that, net of student and institutional factors, gender gaps remained because women may engage in behaviors that make it more likely they will enroll and be successful in college. They also suggested that the pathways to higher education completion may have changed in gender specific ways, for instance via grade inflation in female dominated majors.

Race

Racial disparities exist at every stage of the pipeline towards a bachelor’s degree: high school graduation, college enrollment and college completion (Ishitani & DesJardins, 2003). In the 2007-08 school year, the average high school graduation rate for white students was 81%, but just 64% for Hispanic students, and 62% for black students (Stillwell, 2010). Despite the challenges in graduating from high school, the enrollment of minority students in college
increased greatly since the 1970s. Although larger numbers of minorities are enrolling in college, Black and Hispanic students’ enrollment varies across college selectivity (Reardon, Baker, & Klasik, 2012; Posselt, Jaquette, Bielby, & Bastedo, 2012). Using data from the NLS, HS&B, NELS, and ELS, Posslet et al. (2012) claimed that students from all racial and ethnic groups have better academic preparation in 2004 than in 1972, but minorities had lower odds of enrolling in selective institutions. Furthermore, college graduation rates between whites and minority students differ substantially (Bowen & Bok, 1998, Bowen et al., 2009, Braxton, Brier, & Hossler; 1988).

Disparities in enrollment and college completion may be due to differences in student characteristics across groups. Several studies have shown that black and Hispanic students were more likely to be first-generation college students, low-SES, and have lower levels of academic preparation (Fischer, 2007; Bowen & Bok, 1998; Bowen et al., 2009; Massey, Charles, Lundy, & Fischer, 2002). After controlling for student characteristics, researchers found conflicting results with regard to gaps in enrollment. Reardon et al. (2012) found that racial disparity in selective college enrollment remained after accounting for income differences. However, Posselt et al. (2012) found that controlling for student background characteristics, including income, and academic preparation resulted in minority students higher likelihood of enrollment in selective institutions. Charles et al. (2009) found that, after controlling for the same factors, minority students earn the same grades and persist at the same rates as whites. Other findings suggest that racial differences in enrollment and completion remain after accounting for variation in student background characteristics and academic preparation (Bowen et al., 2009; Fischer, 2007).
Race also appears to interact with many student and institutional variables. Using data from the National Longitudinal Survey of Freshman, Fisher (2007) studied outcomes from a national probability sample of over 4,000 first-time students entering selective colleges. His work suggests that being a first-generation college student is related to lower grades for whites and Hispanics. Greater numbers of on-campus experiences and friends tend to reduce the likelihood of attrition for all students, but to varying degrees. For black and Hispanic students, greater involvement in extra-curricular activities reduces the likelihood of attrition by over 80%. Fisher (2007) also found that as the percentage of freshman in the top 10% of their high school class at a college increased, the likelihood of black students dropping out reduced. These findings corroborate Astin’s (1993) findings on the effects of interaction race/peer group interactions on student outcomes.

**Socioeconomic status (SES)**

Student socioeconomic status (SES) is one of the most commonly used predictors of student educational outcomes. It is defined as combination of the income, educational attainment, and occupational prestige of a student’s parents and it provides information on a student’s social status (Walpole, 2003). Due to limited information on parent occupation, many education studies operationalize student SES as a continuous or categorical variable that combines parent income and educational attainment (Reardon, 2011; Titus, 2006). Expectations and definitions of educational success for a child vary with parental social status and are an important factor in moderating student aspirations.

At every stage in the educational pipeline low SES students have worse outcomes than high SES students. Substantial disparities in academic achievement, high school graduation,
college enrollment, and college completion exist. Conditional on enrolling in college, the national four-year bachelor’s completion rate for the highest SES students was 46%; however, just 19% of the lowest SES students completed a bachelor’s within four years. Of those that took longer than four-years to complete a degree, 47% of the lowest SES students completed, compared to 81% of the highest SES students (Bowen, et al. 2009). Those low SES individuals that enroll in college are less likely to attend selective institutions and more likely to attend institutions with fewer financial resources (Walpole; 2003; Titus, 2006). Overall, low SES students are less likely to earn a bachelor’s degree, and when they do earn a degree they are more likely to take longer than higher SES students. These results are potentially due to the fact that low SES students are less likely to be academically and socially integrated into the campus (Tinto, 1993; Astin, 1996).

College outcomes are correlated with both student SES and average institutional SES. After controlling for a mix of student background and student academic factors, as well as college characteristics, research shows that low SES students are less likely to enjoy the same educational and life outcomes as their high SES counterparts (Adelman, 2006; Bowen et al., 2009; Astin, 1993; Titus, 2006; Walpole, 2003). For those low SES students who do complete a degree, they are more likely to have lower incomes, lower aspirations, and lower levels advanced degree attainment (Astin, 1993; Walpole, 2003). Evidence also suggests that income matters more than parental educational attainment. Bowen et al. (2009) found that the attainment rate of the richest first-generation college students was higher than that of the poorest students with at least one college educated parent. The relationship between student SES and college completion also appears to depend on the selectivity and control of the institution attended (Bowen et al., 2009). At highly selective private colleges there is essentially
no difference in graduation rates between high and low SES groups. The graduation rate disparity between groups appears in public institutions. There is also a significant positive relationship between average institutional SES and individual college completion (Titus, 2006).

Several potential causes for SES effects on attainment have been proposed by researchers. The contextual influence of SES may be attributable to peer group effects. These results may be due to selection effects into the colleges, support and context of the colleges, or some combination of the two. Research shows that many high SES students attend colleges that enroll high percentages of other high income students, while low income students attend colleges with students from a variety of SES backgrounds. Parental interaction styles and expectations, as well as school structure, experiences, and expectations are thought to contribute to differences beginning at a young age (Walpole, 2003). These differences eventually result in disparities in academic preparation by the time the student is old enough to enroll in college (Bowen et al., 2009). Low SES students also engage in college choice processes and may have different institutional experiences while attending college (McDonough, 1997; Astin; 1993; Tinto, 1993; Hossler, Schmit, & Vesper, 1999). In addition to these long term consequences of SES, short term consequences, such as inability to pay for a semester or purchase necessary materials, are also thought to play a role in the attainment gaps between low and high SES students (Bowen et al., 2009).

**Educational Aspirations**

An educational aspiration - the desire for educational attainment - is assumed not only to be a prerequisite for students to enroll and persist in college, but also is an important component of persisting in and completing college (Tinto, 1993; Astin, 1993). Carter (2002)
suggests that students’ educational aspirations are shaped by their parents, career goals, college experience, academic achievement, and social environment.

While most studies examine factors that influence educational aspirations, there are some which demonstrate that educational aspirations are positively related to educational attainment (Carter, 2002; Pascarella & Terenzini, 2005). One other study also found that for first-generation students, educational aspirations were the best predictor of first semester GPA (Naumann, Bandalos, & Gutkin, 2003). In opposition to these findings, Adelman (2006) established that student anticipations, a variable derived of student aspirations measured over time, did not predict educational attainment for high school seniors. Educational aspirations are highly variable over time, which may make establishing their relationship with degree completion more challenging (Ingles, Curtin, Kaufman, Alt, & Chen, 2002). Additionally, comparable and consistent measures of aspirations across studies are rarely available (Adelman, 2006).

Today, more students aspire to earn a bachelor’s degree than ever before. High school student’s aspirations for earning a bachelor’s degree have increased from 40% in 1980 to 80% in 2002 (Roderick, Nagaoka, & Coca, 2009). This increase in aspirations occurred across racial and income lines, with low-income students registering the largest gains (Roderick et al., 2009; Venezia, Kirst, & Antonio, 2003). However, despite having aspirations to earn a bachelor’s degree, only 60% of students have the academic preparation needed for college (Venezia et al., 2003).
Institutional Characteristics

Public/Private Control

Public or private control of an institution is typically considered a structural feature of a college or university. Net of student and institutional differences, the relationship between institutional control and student graduation is most likely indirect and affected by other institutional characteristics. Compared to public colleges, private colleges may have different missions, additional financial resources, or different types of faculty and peer relations.

Research that examines degree completion rates at public versus private institutions consistently finds higher rates of completion at private schools. The public/private differences exist across individual and institutional rate comparisons. After accounting for selectivity, private institutions have about a 10 percentage point higher five-year average graduation rates compared to public institutions (Pascarella & Terenzini, 2005; Bradford & Farris, 1991). The private advantage also emerges during longitudinal studies on the completion of individuals (Astin, 1993; Horn, 1998).

After adjusting for other student and institutional covariates, the findings for public/private differences are mixed. For instance, studies of both individual and average institutional completion rates in four-year institutions that controlled for a variety of student background characteristics, college experiences, institutional size, selectivity, and financial expenditures found that a small, but significant advantage in completion remained for private institutions (Astin, 1993; Astin, 1996; Ethington, 1997; Titus, 2006; Morrison, 2013). Other research found that the completion advantage of private colleges does not remain after controls are applied. Using data from IPEDS, Scott, Bailey, and Kienzl (2006) found that student
characteristics explained the gap in average graduation rates between public and private institutions. When controlling for selectivity, Bowen et al. (2009) found that public and private institutions had different four-year graduation rates, but similar six-year rates.

**Campus Enrollment**

Enrollment is usually considered a structural characteristic of an institution that contains information about the college organizational environment and the strength of relationships among its members (Berger & Milem, 2000; Pascarella & Terenzini, 2005). Size is thought to influence educational outcomes by affecting the way in which students socially integrate into the institution (Pascarella & Terenzini, 2005) or by the percentage of institutional expenditures on administration (Titus, 2006). Larger institutions may spend more money on administrative functions, or may have different opportunities for student involvement, which may affect students’ interactions with faculty members and peers. Enrollment is operationalized in multiple ways, with some studies using enrollment as a continuous variable, others standardizing it, and still others dividing it into categories (Astin, 1993; Titus, 2006, 2004; Ishitani & DesJardins, 2003).

Research findings on the effect of enrollment on persistence and degree completion are inconsistent and inconclusive. Astin (1993), using a nationally representative sample of students in four-year institutions, found that the association between persistence and enrollment weakened as enrollment increased. Other research (Bowen et al., 2009) concluded that institutional size was not related to degree attainment, but rather that program/major size was more important for degree attainment. A number of studies (Morrison, 2013; Ishitani & DesJardins, 2003; Titus, 2004) suggested that an increase in enrollment related to an increase in institutional average graduation rates. But, at least two studies (Ethington, 1997; Titus, 2006) find that size does not have a statistically significant relationship with average graduation rates.
after controls are applied. The variation in these findings could be due to different types of models being specified, different operationalization of enrollment size, or due to the populations being studied.

**Financial Expenditures**

Institutional financial expenditures are theorized to affect the types, number, and quality of the interactions students have on campus, which in turn are directly or indirectly related to persistence and degree attainment. Tinto’s (1975), Spady’s (1971), or Bean’s (1980) conceptual models did not explicitly mention institutional financial expenditures, but Astin’s (1993) study suggested that the percentage of expenditures devoted to student services and instruction may relate to student attrition. Ryan (2004) claimed that institutional financial expenditures shaped the institutional environment through a mixture and quality of faculty staffing and expertise, the types of programming, services, and support available, as well as opportunities for innovation and improvement.

The four most common institutional financial expenditures studied by researchers are those for academic support, student services, instructional support, and administrative support (Peerenboom, 2012; Pike, Smart, Kuh, Hayek, 2006). Academic support includes those expenses that are primary to the mission of instruction and research, such as libraries, museums, technology, academic administration, and curriculum development. Student services expenses are primarily focused on students’ emotional and physical health, as well as their professional and social development. Instructional expenses include general academic instruction, adult basic education, remedial education, and any special instruction conducted by the faculty. Administrative support, also called institutional support, funds the daily administrative, legal,
and public relations operations of the institution, excluding expenses for physical plant operations. Because expenditures are reported in dollar amounts, researchers typically use a log transformation to change the interpretation from a one unit increase to a 1% increase.

In general, the relationship between the four most common institutional expenditures and their relationship to average institutional graduation rate is uncertain (Astin, 1993; Ryan; 2004; Scott, Bailey, & Kienzl, 2006; Titus, 2006b; Webber & Ehrenberg, 2009). Academic support expenditures have shown a positive correlation with graduation rates (Ryan, 2004; Webber & Ehrenberg, 2009), however, one study found no significant relationship between the two. Depending on the study, student services has shown a positive (Webber & Ehrenberg, 2009; Chen, 2012), negative (Ryan, 2004), or non-existent relationship (Titus, 2006b) to average institutional graduation rates. Instructional support is the only expenditure with a positive relationship to graduation rates across all studies (Ryan, 2004; Webber & Ehrenberg, 2009; Astin, 1993). Conversely, researchers have consistently found negative correlations between administrative support expenditures and graduation rates (Fowles, 2010; Ryan, 2004; Titus, 2006b). Astin’s (1993) study appeared to be unique in its examination of the relationship between institutional financial expenditures and student-level outcomes. His work found that instructional support and student support expenditures had a small, indirect relationship with the probability a student graduates. Mixed results for the studies linking financial expenditures with average graduation rates may be due to different types of analytical samples, different analytical methods, or the control variables included in the studies.
**Student-to-Faculty Ratio**

Student-faculty interaction is a fundamental type of activity in college that is hypothesized to affect student outcomes. Student-faculty interaction is thought to increase socialization and student commitment to college (Berger & Milem, 2000; Milem & Berger, 1997; Pascarella & Terenzini, 2005; Tinto, 1993). Positive faculty interactions socialize students to the values and attitudes respected by academe and strengthen students’ bonds to their institution (Pascarella & Terenzini, 2005). Despite the evidence that increased student-faculty interaction improve educational outcomes controlling net of student and institutional factors, selection bias may still be operating: some more motivated students may be more likely to seek out faculty interaction than others. Because obtaining data on individual student interactions with faculty is costly, difficult, and time consuming, student-faculty ratios have been used as a proxy for student-faculty interactions or institutional resources in many higher education studies (Chen, 2012; Bound et al., 2009; Scott et al., 2009). In addition to socialization and commitment, student-faculty ratio has been used as a measure of institutional resources (Bound et al., 2009; Scott et al., 2009).

Changes in student-faculty ratio have also been associated with changes in the probability a student completes over time. When comparing the individual outcomes from the NLS:72 and NELS:88, Bound et al. (2009) showed that changes in student-faculty ratio accounted for one quarter of the change in the probability a student completes a degree. While most studies report positive, significant correlations for student-faculty ratio on outcomes, two studies did not find a significant relationship. Chen’s (2012) event history analysis using BPS data found that student-faculty ratio was not a significant predictor of individual student dropout. Scott et al. (2009) used IPEDS data to examine the relationship between student-faculty ratio
and institutional six-year graduation rate. Their analysis did not find that student-faculty significantly predicted average six-year institutional graduation rate.

Net of other factors, student interaction with faculty members appears to promote student persistence, educational aspirations, and degree completion (Pascarella & Terenzini, 2005; Astin, 1993; Bound et al., 2009; Kuh & Hu, 2001; Umbach & Wawrzynski, 2005; Kuh, Bridges, & Hayek, 2006). Interacting with faculty on campus has been shown to improve student persistence, time studying, and GPA (Kuh & Hu, 2001; Kuh, 2003; Pascarella & Terenzini, 2005). Studies have also found that working on faculty research projects and visiting with faculty outside of class was positively associated with student satisfaction and educational attainment (Astin, 1993; Umbach & Wawrzynski, 2005).

**Percentage of Minority Students and Part-Time Students**

The type of campus climate is thought to influence outcomes such as persistence and graduation. Campus climate is an indicator of the type of social relations that take place on a college or university campus. The make-up of the college study body and the types of faculty at a college are factors that may influence the campus climate. Numerous studies have studied the influence of campus climate on learning and other educational outcomes.

In particular, peers have been identified as particularly contributor to the academic and personal development of a student on campus (Astin, 1993). Peers have the strongest effects at institutions with more homogenous student bodies (Pascarella & Terenzini, 2005). The aggregate characteristics of the students at a particular college combine to form the peer environment of the institution (Titus, 2004). Astin (1993) hypothesized that students tend to conform to the behaviors and perceptions of their peers. When an individual student’s
behaviors and perceptions conform to that of the peer group at the institution the student feels socially integrated with the institutional environment. Characteristics shared by the majority of students will form a dominant peer environment on campus and smaller subgroups may also have peer environments that influence individual students (Pascarella & Terenzini, 2005). Collectively, the combination of students at an institution creates a unique institutional peer climate.

Studies have operationalized the campus climate at an institution by aggregating individual student characteristics to institutional averages. Two of the most frequently used measures include the percentage of students that live on campus (Astin & Oseguera, 2012; Bowen et al., 2009) and the percentage of minority students on campus (Titus, 2004; Pascarella & Terenzini, 2005). Bowen et al. (2009) found that the percentage of students living on campus was positively related to increased odds of graduation for an individual student, as well as a higher institutional average graduation rate. Another study (Astin & Oseguera, 2012) found that larger percentages of commuter students had a negative relationship with average institutional graduation rates.

Studies examining relationship between the percentage of minority students and completion at the individual and institutional level have found mixed results. Pascarella and Terenzini (2005) noted that black students attending predominantly black institutions are more likely to graduate than similar black students at predominantly white institutions. However, Titus (2004) did not find a significant relationship between the percentage of minority students on campus and the average institutional persistence rate.
The Role of State Context

While neither the interactionist nor organizational frameworks mention state policy, aspects of state context may be related to completing a bachelor’s degree. In his work, Titus has explored how states’ higher education financial policies and the design of states’ higher education systems relate to bachelor’s degree completion within six years at four-year institutions (Titus, 2006b; Titus, 2009). The financial aspects of state higher education policies fall into three broad areas: Appropriations to higher education institutions, tuition policy for public institutions, and student financial aid appropriations. These studies have found that, after taking into account student and institutional characteristics, college completion is positively associated with the percentage of institutional revenue derived from tuition, increases in state need-based financial aid, and increases in state appropriations for higher education.

Titus also finds that the design of the state higher education systems relate to the number of bachelor’s degrees a state produces. For example, some states designed their higher education systems to have large numbers of community colleges and smaller numbers of four year institutions (e.g. Texas, California). Some states possess larger numbers of private institutions, which are more likely to graduate students at higher rates (New York, Pennsylvania). Titus (2009) used a state fixed-effects panel data analysis study the relationship between state characteristics and bachelor’s degree production. His results indicated that as the percentage of undergraduate enrollment in private four-year institutions increased, the number of bachelor’s degrees produced also increased. This finding suggests that aspects of state higher education system design may also play a role in the total number of bachelor’s degrees a state produces. However, to date, no studies have examined the role of state contextual variables and the probability an individual earns a bachelor’s degree within six-years.
Conceptual Model

Based on the interactionist and organizational theories, as well as the extant research on factors related to college completion, I have developed a conceptual model for how student, institutional and state factors relate to bachelor’s degree completion for those high school graduates who have enrolled in college. Figure 2.1 illustrates the conceptual framework for the factors affecting bachelor’s degree completion. The figure suggests that both student and college characteristics are related to the experiences one has in college, as well as the likelihood one completes a bachelor’s degree. Additionally, students’ college experiences are related to bachelor’s degree completion. The college completion process unfolds in a larger state context that has the ability to affect the student and institutional factors, as well as degree attainment.

Student-level variables are divided into the two categories: student academic achievement and student background characteristics. Academic ability is measured by the combination of student high school GPA and SAT scores, and it is hypothesized to contribute to academic integration within a college. As mentioned in the literature review, a student’s background affects his ability to socially integrate into different types of institutional peer and faculty environments. The types of experiences a student has in college are also related to the chances of degree completion, in particular part-time enrollment and transferring.

Institutional factors include of public/private control, financial resources, and measures of the institution’s social attributes. Prior research indicates that control of the institution influences the organizational environment socially and academically through the aggregate achievement of all students. The financial resources devoted to instructional, academic, support, and administrative services are directly related to the production of degrees. Finally, the institutional social attributes are proxy measures for the type of social environment one
finds on campus. These factors may influence the academic environment a student enters and the types of peers a student interacts with in college.

State contextual attributes, such as the number and type of postsecondary options, also relate to the probability of completing a bachelor’s degree. The structure of a state’s higher education system also may influence the chances of earning a degree. For instance the size of the private sector may affect the quality and affordability of postsecondary options for students in a state. Additionally, the number of two-year institutions or existence of transfer policies may affect access, affordability, and completion of degrees.

![Conceptual model of the factors related to bachelor’s degree completion.](image)

**Education Policy and Contextual Factors Affecting the Education Pipeline**

This study spans multiple decades and compares characteristics of students across multiple cohorts and their postsecondary enrollment and completion. To place these cohorts in policy context, I have outlined several major policy reforms and economic contextual events that occurred during the periods the data for this were collected (1980s – 2000s). Table 2.1 highlights some of the major events that may have affected the education pipeline during this period.
Table 2.1
Education Policy and Contextual Factors Affecting the Education Pipeline between the 1980s and 2000s.

<table>
<thead>
<tr>
<th>Year</th>
<th>Events</th>
</tr>
</thead>
</table>
| 1980s | Series of recessions between 1980 - 1982  
A Nation At Risk report identified stagnating test scores and low high school graduation rates as a threat to the nation’s economy  
Federal polices changed family income restrictions on loan amounts  
Federal polices allow loans to be issued to parents  
# of degree-granting four-year colleges in 1981: 1,957 |
| 1990s | Student Right-to-Know and Campus Security Act made reporting of graduation rates mandatory for institutions receiving federal funds  
Recession during 1991-1992  
Veterans returning from the Gulf War were able to us benefits from the G.I. Bill to enroll in college  
During the 1990s, the federal government began creating incentives for states to create standards and evaluate accountability  
More information about colleges and financial aid available on the internet  
# of degree-granting four-year colleges in 1991: 2,141 |
| 2000s | Recession during 2001  
States begin to establish P-20 councils in an effort to link the education pipeline between high school and college  
No Child Left Behind Act in 2001 was the largest federal education measure in history and required states to set educational standards  
Reductions in state appropriations for higher education and increases in tuition costs, particularly in public sector  
Larger shares of grant aid awarded without considering need  
Spellings Commission 2006 report on future of higher education  
Recession and housing crisis in 2008  
# of degree-granting four-year colleges in 2010: 2,774 |


Broadly speaking, the policy and contextual events highlighted in Table 2.1 may have altered the number of students enrolling in college across the 1980s, 1990s, and 2000s, as well as their academic and demographic characteristics. These changes have taken place during a time of economic transition requiring more to people to have some higher education and training beyond high school. Additionally, 817 new four-year institutions opened their doors between 1981 and 2010. The events listed in Table 2.1 relate to three areas affecting higher education: Affordability, access, and academic preparation.

Increasing availability of loans and financial aid affect the affordability of higher education and enables more people to enroll in college. More students received Pell grants in the 2000s than in the 1990s. The number of students receiving Pell grants increased from 4 million in 1992-93, to 4.8 million in 2002-03, and 8.8 million in 2012-2013. The amount of Pell grants has also increased from $2,516 in 1992-93 to $3,650 in 2012-2013 (in 2012 dollars); however, the maximum Pell grant in 2012-2013 covered a smaller percentage of public four-
year tuition and fees than in 1992-93 (63% versus 91%). In addition, the percentage of state grant aid that was based on merit, instead of need, increased. In 1992-93, 10% of all state grant aid was awarded without considering need; this percentage had risen to 23% in 2002-03, and to 26% by 2011-12 (Baum, Payea, & Kurose, 2013).

Between 1992 and 2013, the amount institutions have spent per full-time equivalent student hovered between $11,000 – $12,000 (in 2013 dollars). However, cuts to state appropriations have led to increases in tuition costs to maintain this spending level. For example, in 1992, tuition composed 29% of total revenue per FTE, but by 2013 tuition composed 47% of total revenue per FTE, an increase of 76%. In effect, a large portion of the cost of financing higher education was shifted from the state to students and families (State Higher Education Executive Officers, 2013). Higher tuition is likely to have affected affordability and access for students at public institutions between the 1990s and 2000s.

The rise of the internet during the 1990s and into the 2000s increased the information available students and families about college and financial aid, which may also affect affordability and access. Growing numbers of postsecondary institutions may have improved access by creating more seats for students. Additionally, economic recessions restricted the labor market, which potentially encouraged more students to choose to enroll in postsecondary education. Finally, increasing scrutiny on academic standards and high school graduation may have affected how states and high schools prepare students academically, leading to higher high school GPA’s and test scores over time.

**Summary**

This chapter reviews the way scholars have conceptualized the bachelor’s degree completion process and the factors that affect it. The chapter began by framing the research
using the interactionist and organizational theoretical perspectives. Then it incorporated
information on the state-level factors which situates students in a broader educational context.
Combining these three lenses provides a more nuanced understanding of the process and
correlates of degree completion for individuals.

Using these lenses, I summarized several different student-level factors have been
associated with degree completion. Researchers have shown that student academic
achievement and background characteristics, such as gender, race and SES, are associated with
disparities in enrollment and educational attainment. There is less research on student social
attributes as predictors of completion, but scholars have found that educational aspirations and
transfer are positively associated with earning a degree.

I then summarized the research on the relationships between institutional-level and
state-level factors with college completion. The research on the relationship between
institutional factors, such as public/private control, campus enrollment, financial resources,
student-to-faculty ratio, and the percentage of minority and part-time students on campus, and
college completion has produced conflicting findings. The role of state-level factors has not been
considered in the theoretical frameworks on college completion; however, the emerging
literature suggested that the size of a state’s two-year and private sectors may be related to
bachelor’s degree production.

The chapter concluded with my conceptual framework for the student, institutional, and
state factors related to bachelor’s degree completion. I also review some of the education policy
and contextual factors that may have affected the education pipeline over the last 30 years.
Chapter 3

RESEARCH DESIGN

Purpose, Research Questions, and Objectives

The purpose of this study is to investigate trends in the college pipeline and the relationship between academic achievement and the probability a student completes a bachelor’s degree. To accomplish these purposes, I begin by describing changes in the population of students enrolling on-time in four-year colleges and the high school to college pipeline between 1992 and 2004. Then, building upon the existing literature, I estimate the high school GPA, SAT score, and bachelor’s degree completion relationships using the most recent nationally representative data set. Lastly, I include an intermediate outcome— the college experience of transferring from a four-year institution - to examine the paths by which high school GPA and test scores are related to college completion. In this chapter, I describe the (1) research questions, (2) sources of data, and (3) analytic methods for each question.

This study focuses on three research questions:

1. To what extent has the education pipeline between high school and college changed between 1992 and 2004? Are there changes over time in the characteristics of high school graduates who enroll on-time in a four-year college? Do students’ characteristics differ by college experience?

2. What is the relationship between bachelor’s degree completion within six years and high school academic achievement for students from the 2004 senior cohort enrolling on-time at four-year colleges?

3. To what extent do the experiences of transferring colleges and part-time enrollment mediate the relationship between bachelor’s degree completion
within six years and high school academic achievement for students in the 2004 senior cohort?

The first research question necessitates a description of the populations of high school students moving through college pipeline over time. This analysis will be descriptive rather than inferential in nature. For the second question, regression analysis is the appropriate quantitative method because it focuses on the relationship between a single dependent variable, college completion, and several independent variables (Allison, 2001). This study’s research questions focus on a binary outcome variable, bachelor’s degree completion, which necessitates logistic regression techniques (Allison, 2001). The third question requires path analysis which is born out of multiple regression analyses (Hayes, 2013).

Description of the Data

The data I use for this dissertation come from three different national data sets: Two nationally representative longitudinal studies (NELS:88 and ELS:2002), and the Integrated Postsecondary Education Data System (IPEDS). In this section I describe the sampling and weights, data collection, and questionnaires across the studies.

The National Secondary Longitudinal Studies Program (NSLP) consists of five studies, the NLS:72, HS&B:80, NELS:88, ELS:2002, and HSLS:09, that describe the educational experiences of high school students in the United States. The studies follow students through postsecondary years (Figure 3.1, NLS:72, HS&B:80, and HSLS:09 not pictured). Conducted by the National Center for Education Statistics (NCES) beginning in the 1970s, the goal of the NSLP is to study the educational, vocational, and personal development of students during their educational careers and the factors related to their development (National Center for Education Statistics, 2013). All four of the studies are longitudinal in design—they track individual students over
time. As Figure 3.1 illustrates, each study uses multiple surveys to collect data during high school, two years after 12th grade and seven to ten years after 12th grade. The data from these studies help researchers further understand the correlates of educational outcomes in the U.S.

![Figure 3.1. Time period covered by the National Secondary Longitudinal Studies Program (NSLP) studies used in this dissertation: NELS:88 & ELS:2002 senior cohorts. Source: National Center for Education Statistics, 2013.](image)

This study utilizes restricted-use data from the NELS:88 and ELS:2002, which span educational trajectories of students between 1992 and 2012. Each of these studies administered a series of surveys to students, parents, teachers, and school administrators, as well as collected transcript information from students’ high schools and colleges. The surveys cover a range of topics, including: school, work, and home experiences, educational roles of parents and peers, educational aspirations and student perceptions, work experiences, postsecondary education
experiences, and educational attainment. Each study is designed to provide a nationally representative sample of U.S. high school seniors.

The ELS:2002 data collection began in the spring of 2002. The study utilized a two-stage probability sample to select 17,590 high school sophomores in 750 schools. The sample was also freshened during the senior year follow-up survey in 2004, resulting in a nationally representative sample of high school seniors. A second follow up two-years after high school graduation (2006) and a third follow up in 2012 collected information on students’ employment and postsecondary outcomes.

NELS:88 data collection started with the 8th grade class in spring 1988 and used a similar two-stage probability sample to select 26,430 8th graders across 1,050 schools. Follow-up surveys took place in the student’s sophomore year (1990) and senior year (1992). The senior year sample was freshened with new members to represent the nation’s high school seniors. Additional follow-up surveys were conducted in 1994, and 2000 to obtain employment and postsecondary outcomes.

The questionnaires from the ELS:2002 and NELS:88 contain some similar items across cohorts, which enables trend analysis (Ingels, Pratt, Wilson, Burns, Currivan, Rogers, & Hubbard-Bednasz, 2007). The variables used for this study were selected based on their cross-cohort comparability. The NELS:88 Second Follow-up Student Component Data File User’s Manual contains a cross-walk of identical items across the NELS:88, HS&B:80, and NLS:72 questionnaires (Ingels, Dowd, Baldridge, Stipe, Bartot, & Frankel, 1994). This dissertation includes data for each study from the following three waves:
1) The high school senior follow-up and high school transcript study which includes student background, high school experiences, grades, standardized test scores, and graduation status;

2) The two-year post-high school follow-up survey provides data on students’ college experiences;

3) The final follow-up survey and postsecondary education transcript data on student outcomes;

The NELS:88 and ELS:2002 studies survey high school students during their sophomore and senior years of high school, two years after high school graduation, and 8 years after high school graduation. I restrict comparisons to those students who have completed a bachelor’s degree within six years of high school graduation because that is most frequently used measure of completion by scholars, policymakers, and practitioners. This is done by recoding those students who have completed a bachelor’s degree and have a date of graduation greater than six years after the on-time high school graduation date as non-graduates. This adjustment should have a small effect on the completion rates, as only 9.5% and 6.5% of all bachelor’s degree recipients graduate after six years in the ELS:2002 and NELS:88, respectively.

I merged IPEDS data with each NSLP data set in order to obtain information on college characteristics of the first institution students attend. IPEDS is a system of surveys administered by (NCES) that gathers information from every postsecondary institution that participates in federal student financial aid programs. Institutions are mandated to report data on enrollment, completion, graduation rates, faculty and staff, finances, and financial aid. I utilized IPEDS data

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5 This group of students is a very small. See Appendices A and B for descriptive statistics on the number of students who graduate after 6 years.
from the 1992-93 and 2004-2005 academic years to coincide with the NELS:88 and ELS:2002 senior cohorts, respectively.

Limitations

Although each study was designed to provide comparable information on students across time, there are limitations in using the data to make cross-cohort comparisons. First, while I selected variables for this study based on their cross-cohort comparability, there are some differences in wording or response options across the three studies.

Second, across each study some individuals may not participate in a particular wave of survey administration. While nonresponse adjustments in the survey weights compensate for unit nonresponse to an entire wave, survey weights do not address possible selection patterns associated with nonresponse. Furthermore, each survey has modest levels of item nonresponse.

Third, as discussed in the literature review, changes in educational policy at the state and national levels are not accounted for and so the effects of these changes may be confounded with the effects of measured predictors, such as measures of high school achievement or the enrollment numbers at colleges and universities.

Analytic Samples

The research questions for this study pertain to nationally representative samples of young adults who graduated from high school on-time (i.e. May or June of their scheduled senior year), and enrolled in a four-year college on-time (i.e. within seven months of high school
Below I describe how I derive the analytic samples from the ELS:2002 and NELS:88 studies from the full sample of students.

**Analytic Sample from the ELS:2002**

The ELS:2002 sample includes 16,200 high school sophomores in the spring of 2002 that represent more than 3.2 million high school sophomores nationally (Table 3.1). Just over 87% of these sophomores reached senior year of high school on-time, and 81% graduated on-time in June 2004 (2.7 million students represented by just over 13,000 sample members). Of the on-time graduates, 48% enrolled in a four-year college within seven months of high school graduation (nearly 1.3 million students nationally, represented by 5,960 students). Ninety percent of the students who enrolled in a four-year college on-time had complete data on all outcome measures, constituting an analytic sample of 5,350 students, representing over 1.1 million students nationally. Overall, 39% of high school sophomores in 2002 went on to enroll in a four-year college on-time.

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The decision to exclude students that delayed enrollment from the analyses was made after comparing outcomes and predictor variables for delayed and on-time students. In general, delayed enrollment students are more likely to have missing outcome data, be a minority, male, low-SES, and have lower academic achievement than students that enroll in college on-time. See Appendix C for a comparison of characteristics between on-time/delayed enrollment students at four-year institutions.
The NELS:88 sample includes 11,190 eighth grade students in the spring of 1988 that represent more than 3.1 million eighth graders nationally (Table 2). An estimated 81% of these eighth graders reached senior year of high school, and 70% of eighth graders graduated high school on-time in June 2004. Of the on-time high school graduates, 47% enrolled in a four-year college within seven months of high school graduation (4,530 students representing just over 1.0 million students nationally). Nearly all students (98%) that enrolled in college on-time also had complete data on all outcome measures. The final analytic sample of 4,420 students represents over 1.0 million students nationally. Overall 38% of high school sophomores in 1992 went on to enroll in four-year college on-time.

Table 3.1

Selection of Analytic Sample for Students in the ELS:2002

<table>
<thead>
<tr>
<th>Sample</th>
<th>Unweighted N</th>
<th>Weighted N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sophmores in the base year ELS:2002</td>
<td>16,200</td>
<td>3,287,050</td>
<td>100</td>
</tr>
<tr>
<td>2004 senior cohort members</td>
<td>14,020</td>
<td>2,844,240</td>
<td>87</td>
</tr>
<tr>
<td>HS seniors that graduated in spring 2004b</td>
<td>13,140</td>
<td>2,674,740</td>
<td>81</td>
</tr>
<tr>
<td>Number of HS graduates that ever enrolled in college</td>
<td>10,160</td>
<td>2,410,910</td>
<td>73</td>
</tr>
<tr>
<td>HS graduates who ever enrolled in a 4-year college</td>
<td>6,450</td>
<td>1,428,850</td>
<td>43</td>
</tr>
<tr>
<td>HS graduates who enrolled ina 4-year college on-timec</td>
<td>5,960</td>
<td>1,292,910</td>
<td>39</td>
</tr>
<tr>
<td>(1) Missing bachelor's completion</td>
<td>330</td>
<td>126,580</td>
<td>4</td>
</tr>
<tr>
<td>(2) Missing transfer, but not (1)</td>
<td>280</td>
<td>56,530</td>
<td>2</td>
</tr>
<tr>
<td>(3) Missing full-time/part-time, but not (1) OR (2)</td>
<td>0</td>
<td>1,420</td>
<td>0</td>
</tr>
</tbody>
</table>

Analytic sample: Students who enrolled in a 4-year college on-time and had no missing outcome data

<table>
<thead>
<tr>
<th></th>
<th>Unweighted N</th>
<th>Weighted N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytic sample: Students who enrolled in a 4-year college on-time and had no missing outcome data</td>
<td>5,350</td>
<td>1,166,330</td>
<td>35</td>
</tr>
</tbody>
</table>

Notes: (a) Figures rounded to the nearest 10. (b) Seniors missing high school graduation information were imputed as on-time graduates if they did not delay enrollment in college. (c) On-time enrollment is defined as enrolling in college during the fall 2004 semester.

Variables

The theoretical frameworks and empirical research reviewed in Chapter II of this dissertation suggest that a wide range of variables may be related to college completion. Table 3.3 groups the factors reviewed in Chapter II, along with several other variables that are thought to relate to college completion, but were unavailable in the data used for this study. I have grouped the extended list of factors related to bachelor’s degree completion into four major areas found in Table 3.3.
Pre-college characteristics are student and high school factors that measure academic ability, personality traits, social experience, as well as academic and social environments in high school. In-college factors include measures of academic and social integration, social experience on campus, college affordability, and employment. Institutional-level factors that may influence bachelor’s attainment include measures of social context, financial resources for education, and the availability of academic and social support for students. Finally, state-level factors that may matter include access to four-year college sectors and public institutions, state funding for higher education, tuition, and financial aid, as well as the value of degrees in a state’s labor market.

Although this study would ideally contain measures for all of the factors presented in Table 3.3, several limitations prevent their inclusion in this study. First, some variables are not available in the data set, such as state context variables and measures of college peers, mentors, and tuition. Second, data on student experiences in college is limited. Precise information on grants, loans, first-year grades, and academic involvement was not available in the NELS:88 or ELS:2002. In some cases, such as with on-campus residence and work study, data was available in the ELS:2002, but not the NELS:88. In other cases, such as family income, parent education,
and personality, data was available in both datasets; however, the comparability of the items was questionable. As a result of these limitations a smaller set of variables were used in the analyses.

This study used measures of pre-college student characteristics, college characteristics, and state characteristics as control variables, while experiences in college are deemed intermediate outcomes. Unweighted high school GPA and standardized test scores (i.e. academic achievement) will be included as predictor variables of interest. Following previous research, I also include college experiences such as part-time enrollment intensity and whether or not a student transferred as key intermediate outcomes in the completion process. Table 3.4 provides definitions for these variables.

Table 3.4
Description of Variables Used in the Study

<table>
<thead>
<tr>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Final Outcome</strong></td>
</tr>
<tr>
<td><strong>Bachelor’s in Six Years</strong> – A binary variable where 1 = student earned a bachelor’s degree within six years of on-time high school graduation; and 0 = student did not earn a bachelor’s degree within six years of on-time high school graduation.</td>
</tr>
<tr>
<td><strong>Intermediate Outcomes: College Experiences</strong></td>
</tr>
<tr>
<td><strong>Transfer</strong> – A binary variable where 1 = the student transferred at least once between postsecondary institutions; and 0 = the student did not transfer between postsecondary institutions.</td>
</tr>
<tr>
<td><strong>Part-time Enrollment</strong> – A binary variable where 1 = the student enrolled part-time in the first institution she attended; and 0 = the student enrolled full-time in the first institution she attended.</td>
</tr>
<tr>
<td><strong>Predictor Variables</strong></td>
</tr>
<tr>
<td><strong>High School Academic Achievement</strong></td>
</tr>
<tr>
<td><strong>Unweighted High School GPA</strong> – A standardized variable where 0 is the mean value in the analytic sample (3.21) and a one standard deviation increase is equal to 0.54 GPA points. This measure includes academic and non-academic courses</td>
</tr>
</tbody>
</table>
SAT Test Score Equivalent – A standardized variable where 0 is the mean value in the analytic sample (1,063) and a one standard deviation increase is equal to 180.62 points. This is a composite measure of a student’s highest test score on the SAT scale. ACT scores were converted to SAT scores using a concordance table (ACT, 2011).

Student Background Characteristics

Male – A binary variable where 1 = the student is male; and 0 = the student is female.

Minority – A binary variable where 1 = the student identifies as not white; and 0 = the student identifies as white.

Socioeconomic Status (SES) – A standardized variable that is a composite measure of the student’s family income, parent education, and parent job status where 0 is the mean value in the population of high school students (Lauff & Ingels, 2013).

Educational Aspirations – A categorical variable where 3 = the student aspires to a masters, professional, or doctoral degree; 2 = the student aspires to a bachelor’s degree; and 1 = the student aspires to less than a bachelor’s degree.

College Characteristics of the First Institution Attended

Control – A categorical variable where 3 = private for-profit, 2 = private non-profit; and 1 = public.

Financial Expenditures (in thousands of dollars per student) – A continuous variable that measures the institution’s financial expenditures on academic support, instruction, institutional support, student services, scholarships and grants, and plant operations in 2014 dollars.

Total Undergraduate Headcount Enrollment (in thousands) – A continuous variable that is the sum of the full-time and part-time undergraduate students enrolled at the institution.

Percentage of Part-Time Students – A continuous variable on a scale from 0 to 100 that is the number of part-time undergraduate students divided by the total number of undergraduate students at the institution.

Percentage of Students that are Minority – A continuous variable on a scale from 0 to 100 that is the number of minority undergraduate students divided by the total number of undergraduates students.

Student-to-Faculty Ratio – The student to faculty ratio is calculated as the total undergraduate headcount enrollment divided by the total number of full-time and part-time faculty at the institution.

State Level Characteristics

Percentage of State Postsecondary Enrollment in 2-year Institutions – A continuous variable on a scale from 0 to 100 that is the total undergraduate headcount enrollment at private institutions divided by the total undergraduate headcount enrollment in the state where the student attended high school.

Percentage of State Postsecondary Enrollment in Private Institutions – A continuous variable on a scale from 0 to 100 that is the total undergraduate headcount enrollment at two-year institutions divided by the total undergraduate headcount enrollment in the state where the student attended high school.
Missing Data

Across the three datasets missing data can arise from a variety of reasons. One source is students skipping an entire wave of survey administration, a type of missingness that is called unit nonresponse. Within a survey wave, missingness may result from incomplete responses or refusal to answer a question (i.e. item nonresponse). Panel weights are designed to account for unit nonresponse by excluding students who skip a survey wave from longitudinal analysis. In the instances where a student responds to a wave, but particular items are missing data, multiple imputation was used for cases with missing predictor variables and listwise deletion was used for cases with missing final and intermediate outcomes.

Missing data is one possible threat to the external and internal validity of a study. When data are missing the findings of a study may not be generalizable to the population as a whole. Furthermore, missing data threatens the internal validity of the study and limits statistical power. For this study I have assumed that missing data are missing at random. The missing at random assumption states that missingness of a variable may depend on the other variables in the model, but it does not depend on the variable itself after taking the other variables into account (Allison, 2002). When data are assumed to be missing at random multiple imputation can be used to increase sample size and maintain unbiased estimates (Allison, 2002).

Table 3.5 displays the missing data for the ELS:2002 and NELS:88 four-year college analytic samples. In particular, 6% of students in the ELS:2002 analytic sample are missing high school GPA and 11% of students in the NELS:88 sample are missing high school GPA. About 9% of students in the ELS:2002 and 21% of students in the NELS:88 analytic samples are missing SAT scores. ELS:2002 sample members have a higher percentage of missing data on educational aspirations than NELS:88 sample members (9% versus 4%). Less than 2% of students are missing
data on most institutional characteristics. However, 47% of students in the ELS:2002 are missing data on student-to-faculty ratio, compared with less than 1% in the NELS:88.

A comparison of the amount of missing data for the ELS:2002 and NELS:88 groups revealed that the differences are small (between 2-3 percentage points), but they are still important to note. Students in the ELS:2002 missing student-to-faculty ratio are more likely to be transfer students, minorities, and have higher educational aspirations. They are more likely to attend colleges with smaller total enrollment, lower percentages of part-time students, higher percentages of minority students, higher expenditures per student, and less likely (17 percentage points) to attend a public institution (Appendix D).  

I conducted multiple imputation for the predictors in the analytic sample using PROC MI with a Markov Chain Monte Carlo method in SAS (Allison, 2002; Yuan, 2011). This seemed reasonable, as missing data diagnostics produced by PROC MI shows that the data in this study’s analytic sample has an arbitrary pattern of missingness. The Markov Chain Monte Carlo method is used as the preferred approach to impute values for data sets with arbitrary missing patterns (Yuan, 2011). Fifty imputed data sets were created to produce the imputed values which were then rounded to produce appropriate values (Allison, 2001).

---

7 Investigation into missing instances of student-to-faculty ratio revealed that it is missing due to missing data on the number of faculty reported by institutions, as most institutions reported data on student enrollment, finances, and institutional characteristics. It is unclear why nearly half of the institutions in the sample chose not to report the instructional staff/salary survey component of IPEDS.
Weighting

Because the two studies incorporate complex sampling designs, sampling weights must be used in order to generate descriptive statistics that reflect the population (Buckley, 2013).

Weighting a sample adjusts for the unequal probability of selection and study sampling design so that inferences to the intended population can be made. Panel weights are the appropriate
weight to use when looking at the same individuals across multiple survey waves and across the two cohorts (NELS:88 and ELS:2002).

When doing analyses that require statistical tests, an adjustment to the panel weight must be made in order to obtain correct standard errors (Hahs-Vaughn, 2005). The purpose of the panel weight is to adjust the sample size to reflect the population size in order to obtain correct descriptive statistics. However, the weights pose a problem when conducting statistical tests because statistics software will assume the population size, not the sample size, when calculating standard errors (Williams, Ferraro, Roey, Brenwald, Kastberg, Jocelyn, Smith, & Stearns, 2009). This process results in standard errors that are too small, which increases the Type I error rates (i.e. the chance of saying a statistically significant relationship exists when it does not). As a result, the weights must be normalized by dividing the panel weight by the mean weight of the entire sample (Hahs-Vaughn, 2005). This adjustment restricts the software to calculating the standard errors with the sample size rather than the population size.

Analytic Methods

This study uses a mix of descriptive statistics and multivariate models to answer the research questions posed at the beginning of Chapter III. For Research Question #1, I descriptively compared the education pipeline for students in the 2004 senior cohort with the education pipeline from the 1992 senior cohort. Additionally, I also compared the characteristics of students from the 2004 cohort that enrolled in college on-time with peers from the 1992 cohort. Research question #2 required the use logistic regression to examine the relationship between academic achievement and bachelor’s degree completion, controlling for student, institutional, and state characteristics. The results of the logistic analysis were used to construct a path analysis for Research Question #3, which parsed out to what extent the college
experience of transferring from a four-year institution mediates the relationship between academic achievement and bachelor’s degree completion. In this section I describe the methods used to answer each research question.

**Research Question #1**

To what extent has the education pipeline between high school and college changed between 1992 and 2004? Are there changes over time in the characteristics of high school graduates who enroll on-time in a four-year college? Do students’ characteristics differ by college experience?

The first question is addressed through descriptive comparisons across the three cohorts of students. First, I described changes in the education pipeline for high school seniors across the ELS:2002 and NELS:88 Next, I discussed the descriptive statistics for the ELS:2002 analytic sample and detailed how the analytic samples from the NELS:88 differs. Finally, I conducted a descriptive comparison of the ELS:2002 analytic sample with four subgroups of students, each with different college experiences: those who enrolled full-time at one institution, those who transferred, those who enrolled part-time, and those who enrolled part-time and transferred. The descriptive comparisons examined the extent to which students with different college experience also differ in their bachelor’s degree completion rates and student, institutional, and state characteristics.

**Research Question #2**

What is the relationship between bachelor’s degree completion within six years and high school academic achievement for students from the 2004 senior cohort enrolling on-time at four-year colleges?
One of the challenges in studying the relationship between student academic achievement and college completion is that there are other factors that may confound the relationship. There may be other student characteristics, college characteristics or state-level contexts that are correlated with to both high school academic achievement and college completion. Also, it is possible that a part of the observed relationship between student background characteristics and college completion may, at least partially, operate through the process of choosing a college. Examining the choice process is beyond the scope of this study as I am choosing to focus on the group of students who enroll in college.

I used series of logistic regressions with PROC LOGISTIC to model the contributions of students’ academic achievement to bachelor’s degree within six years of high school graduation, while controlling for student background, college, and state characteristics (Allison, 2001). Logistic regression controls for the observable factors that may confound the relationship between student characteristics and college completion. Sensitivity tests were conducted to determine if estimating the models with correction for correlations (i.e. with GEE) between subjects within the same postsecondary institution was needed. The within-institution correlations were very low (i.e. less than .10). Nevertheless, within-institution correlations will be reported with the results.

Equation 3.1 states that the log odds an individual completes a bachelor’s degree within six years of high school graduation is a function of student academic achievement, student background characteristics, college experiences, and characteristics of the student’s first postsecondary institution and state where the student graduated from high school.

---

8 If the correlations for subjects within the same institution were large, the standard errors of the regression estimates would be too small, leading to incorrect hypothesis tests.
\[
\log\left[ \frac{p_i}{1-p_i} \right] = b_{0j} + \sum_{i=1}^{k} b_{ij}X_{ij} + \sum_{i=1}^{w} b_{ij}M_{ij} + \sum_{i=1}^{h} b_{ij}S_{ij} + \sum_{i=1}^{n} b_{ij}C_{ij} + \sum_{i=1}^{r} b_{ij}Z_{ij} \tag{3.1}
\]

Where \( p_i \) is the probability that the student earned a bachelor’s degree within six years of high school completion (i.e. \( Y = 1 \)). Measures of student academic achievement, unweighted high school GPA and SAT score, are denoted by \( X \). Denote the set of college experiences as \( M \), which include binary indicators for full-time or part-time status and whether or not the student ever transferred. Let \( S \) denote the set of student background characteristics that include sex, race, SES, and educational aspirations. Denote \( C \) as the set of college characteristics at the first institution the student attended, which includes public or private control, enrollment size, financial expenditures necessary for degree production, the student to faculty ratio, percentage of part-time students, and the percentage of full-time minority students. Finally, denote \( Z \) as the set of state characteristics which includes the percentage of state postsecondary undergraduate enrollment in private colleges and the percentage of state postsecondary undergraduate enrollment in two-year institutions.

The analysis was conducted in three steps. In each step I analyzed a series of progressive models. Step 1 focused on the relationship between bachelor’s completion and academic achievement accounting for student background, institutional, and state factors. I began with the simple regression of completion on academic achievement as the base model. Subsequently, I added one set of control variables at a time to build a full model that accounted for student background, institutional, and state characteristics. I noted if additional covariates changed the relationship between completion and academic achievement.
In Step 2, I created a series of models regressing the college experiences of transferring on student, college, and state characteristics, again with attention to the academic achievement variables. Similarly to Step 1, variables were added in sets to estimate the full model.

In Step 3, I began by regressing bachelor’s degree completion on the full model from Step 1. Next, I included transfer as a control variable. The focus remained on student academic achievement when transfer was added, as well as on transfer itself. The combination of coefficients on academic achievement and college experiences from all three steps were used for the path analysis in Research Question #3.

**Research Question #3**

To what extent do the experiences of transferring colleges and part-time enrollment mediate the relationship between bachelor’s degree completion within six years and high school academic achievement for students in the 2004 senior cohort?

Another area of interest in studying the relationship between students’ high school characteristics and college completion is to what extent the intermediate decisions that students make in college affect the odds they complete a bachelor’s degree. In particular, students’ experiences such as transferring or enrolling part-time are potential intervening variables because they are may affected by high school GPA and may themselves affect bachelor’s degree completion in six years. In other words, college experiences may mediate some of the relationship between high school GPA and college completion. While mediation is a causal mechanism and this study is only associative, I use the term mediate to indicate that college experiences occur between high school academic achievement and college completion.
In this section, I outline a regression-based approach to establishing mediation (Hayes, 2013). First, I introduce a simple mediation model and explain how it is decomposes relationships into direct and indirect pathways. Next, I introduce the path model that I tested in this study and describe how I obtained the direct effects of academic achievement on college completion, as well as their indirect effects of academic achievement through the transfer and part-time enrollment pathways.

**Simple Model**

Mediation analysis examines how a causal variable \( X \) (e.g. high school academic achievement) transmits its effect on \( Y \) (e.g. earning a bachelor’s degree within six years of high school graduation) through a mechanism \( M \) (e.g. decision about transferring colleges or enrolling part-time). Figure 3.2 represents the basic mediation model in a conceptual diagram.

![Simple Model Diagram](Figure 3.2. Conceptual diagram of the simple mediation model.)

The basic model shows a causal antecedent variable \( X \) influencing the outcome \( Y \) through a single intermediate outcome \( M \). In this model, \( X \) influences \( Y \) through distinct pathways that are found by tracing every way (in this case, two ways) one can get from \( X \) to \( Y \).
The first pathway \( c' \) leads directly from \( X \) to \( Y \); this pathway is the *direct effect* of \( X \) on \( Y \). The second pathway, \( ab \), from \( X \) to \( Y \) is the *indirect effect* of \( X \) on \( Y \) through \( M \). The simple mediation model can also be represented by two statistical equations, which are used to estimate the direct and indirect pathways:

\[
M = b_0 + aX + e_M \quad (3.2)
\]

\[
Y = b'_0 + c'X + bM + e_Y \quad (3.3)
\]

Where \( b_0 \) and \( b'_0 \) are the intercepts, \( e_M \) and \( e_Y \) are the errors in the estimation of \( M \) and \( Y \), and \( a \), \( b \), and \( c' \) are the regression coefficients. It is important to note the coefficients’ interpretations. First, \( a \) from equation 3.2 is interpreted as the effect of \( X \) on the mediator \( M \). The \( b \), from equation 3.3, is interpreted as the effect of \( M \) on \( Y \), controlling for \( X \). Also from equation 3.3, the \( c' \) is interpreted as the direct effect of \( X \) on \( Y \) controlling for \( M \). The model can be made more complex by adding additional mediators or control variables to the equations and changing the interpretation appropriately.

**Model for this Study**

In this study, I identified how two intermediate outcomes in college - transferring from one postsecondary institution to another or enrolling part-time in the first institution a student attended - may mediate the effect of two of antecedent variables, high school GPA and SAT score. Initially, I was interested in conducting a mediation analysis using both of these experiences. However, a small numbers of part time students enrolled on-time in four-year colleges (\( N=160 \)) and earned a bachelor’s degree (\( N = 20 \)). Additionally, descriptive comparisons found that the characteristics of part-time students are considerably different from other high school graduates who enrolled in four-year institution on-time. For these reasons I have decided
to examine transfer and part-time experiences descriptively, but to limit the mediational analysis to focus on the effect of the transfer experience. Figure 3.3 presents the mediator model that is used for this study.

In Figure 3.3, the student academic achievement (i.e. high school GPA and SAT score) are modeled as influencing the final outcome, bachelor’s degree completion in six years, directly and indirectly through the college experience (i.e. mediator) of transfer. Because this study uses dichotomous intermediate and final outcomes logistic regression is required. In order to conduct path analysis using logistic regression the coefficients must be adjusted to account for differences in scaling (Kenny, 2013; Herr, n.d.; MacKinnon & Dwyer, 1993). The models use standardized variables and so produce standardized coefficient estimates.

![Figure 3.3. Conceptual diagram of the mediator model for the relationship between academic achievement and bachelor's degree completion. Note: Control variables are not pictured.](image-url)
The conceptual diagram can be represented by the following two statistical equations:

**TRANSFER:**
\[
\log \left[ \frac{p_j}{1-p_j} \right] = b_{0j} + \sum_{i=1}^{k} a_i X_{ij} + \sum_{i=1}^{h} b_i S_{ij} + \sum_{i=1}^{n} d_i C_{ij} + \sum_{i=1}^{t} l_i Z_{ij} \]  \hspace{1cm} (3.4)

**BACHELORS:**
\[
\log \left[ \frac{p_j}{1-p_j} \right] = b_{0j} + \sum_{i=1}^{k} c'_i X_{ij} + b_1 M_j + \sum_{i=1}^{h} b_i S_{ij} + \sum_{i=1}^{n} d_i C_{ij} + \sum_{i=1}^{t} l_i Z_{ij} \]  \hspace{1cm} (3.5)

In equation 3.4, \( a_i \) is an estimate of the effect of \( X \) on the mediator \( M \), controlling for student, institution, and state characteristics. In equation 3.5, \( b \) estimates the effect of \( M \) on \( Y \) controlling for covariates, and \( c'_i \) estimates the effect of \( X \) on \( Y \) holding the mediating variable and control variables constant. Using the two models, I partitioned the total effects\(^9\) of academic achievement on the final outcome into the specific indirect effects of academic achievement that operate through the transfer pathway, and the direct effect of academic achievement, all controlling for student, college, and state characteristics.

To obtain the specific indirect effect of the academic resource variables, I calculated the product of the coefficients on each academic achievement variable in the regressions predicting the intermediate outcomes with the coefficient from mediator from the final model in Step 3 (i.e. the specific indirect effect of academic achievement is given by \( a_i * b_1 \)). The direct effects of each academic resource variable (i.e. \( c'_{gpa} \) and \( c'_{test} \)) were provided by the final model in Step 3, where bachelor’s completion is regressed on the intermediate outcomes, academic achievement, and control variables. The proportion of the total effect that is mediated was calculated by dividing the sum of the indirect effect by the total effect, \( \frac{ab}{c'} \).

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\(^9\) The total effect for a specific variable, denoted as \( c_i \), is equal to the sum of direct and indirect effects. The total effect can be estimated by regressing the final outcome, \( Y \) on the antecedent variable \( X \) and control variables, but excluding the mediator from the model (Hayes, 2013).
Chapter 4

FINDINGS

This chapter contains three sections, each aligned to one of the three sets of research questions. The first section examines changes in the population of high school graduates who enrolled on-time in four-year colleges in 2004 and 1992. I report descriptive statistics on the students’ college outcomes, college experiences, and college characteristics as well as their academic and background characteristics. The second section describes the results from logistic regression models of bachelor’s degree completion in six-years and transfer status on academic achievement, student background, college, and state characteristics. The third section reports the results from the path analysis and measures the extent to which the experience of transferring college mediates the bachelor’s degree completion and academic achievement relationship.

Research Question #1

To what extent has the education pipeline between high school and college changed between 1992 and 2004? Are there changes over time in the characteristics of high school graduates who enroll on-time in a four-year college? Do students’ characteristics differ by college experience?

To answer these questions, I first mapped out the high school to college pipeline by determining how many high school seniors made it to and through college over from the 2004 and 1992 senior cohorts. Then I compared the descriptive statistics of the two populations of college enrollees. For the 2004 cohort, I compared the descriptive statistics for students with different college experiences—students who were part-time versus full-time and those who transferred schools versus those who attended one institution.
College Pipeline

2004 Cohort

There were 2.8 million students in the 2004 senior cohort. Figure 4.1 displays the college pipeline for the 2004 and 1992 high school senior cohort members. It illustrates how many students in each senior cohort flow from one stage in the pipeline to the next by describing the pathways of 100 students. For the 2004 senior cohort, Figure 4.1 shows that for every 100 seniors, 94 graduated in either May or June of 2004. Of those high school graduates, 90% ever enrolled in college (85 seniors). Of students who ever enrolled in college, 80% enrolled in college on-time (68 seniors). Ninety percent of students enrolling in college on-time had complete data (61 seniors). Of students with complete data, 67% enrolled in a four-year college on-time (41 seniors). Of students that enrolled in a four-year college on time, 59% graduated within six years (24 seniors). Overall, this chart illustrates that for every 100 high school seniors in 2004, 24 earn a bachelor’s degree within six years of entering college through the four-year college pipeline.

1992 Cohort

In the 1992 senior cohort there were 2.5 million students. Figure 4.1 illustrates the flow of seniors from high school through college. It shows that for every 100 seniors, 86 graduated in either May or June of 1992. Of the high school graduates, 88% ever enrolled in college (76 students). Of students that ever enrolled in college, 86% enrolled in college on-time (65 students). Ninety-seven percent of students enrolling in college on-time had complete data (63 students). Of students with complete data, 63% enrolled in a four-year college on-time (40 students). Of students that enrolled in a four-year college on time, 64% graduated within six years (26 students). Overall, this chart illustrates that for every 100 high school seniors in 1992,
26 earn a bachelor’s degree within six years of entering college through the four-year college pipeline.

Figure 4.1. College pipeline for 100 typical high school seniors in 2004 and 1992.
Notes: The 2004 senior cohort size was 2.8 million students. The 1992 senior cohort size was 2.5 million students. (a) Students who enrolled on-time in a four-year college.

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10 Nineteen of the twenty students in the ELS:2002 that did not enroll on-time in a four-year college enrolled in a two-year college on-time. One student enrolled in a less-than-two-year college on-time. Three of the students who enrolled on-time in a two-year college earned a bachelor’s degree within six years.

11 Twenty-two of the twenty-three students in the NELS:88 that did not enroll on-time in a four-year college enrolled in two-year college on-time. One student enrolled in a less-than-two-year college on-time. Four of the students who enrolled on-time in a two-year college earned a bachelor’s degree within six years.
Comparing the Pipelines

Overall, the number of students earning a bachelor’s degree through the on-time four-year college pipeline increased between 1992 and 2004 due to a combination of the larger cohort size and the higher on-time high school graduation rate. Within six years of enrollment, 672,000 students in the 2004 cohort earned a bachelor’s compared with 650,000 in the 1992 cohort. An increase in the number of seniors (2.8 million in 2004 versus 2.5 million in 1992), paired with larger proportions graduating high school and enrolling in a four-year institution on time, resulted in a greater number of students who earned a bachelor’s degree despite a lower college graduation rate.

Even though the pipelines appear to have similar downward trajectories, a closer analysis shows that there are some important differences between the two cohorts. At the beginning of the pipeline, the data show that a greater proportion of seniors in 2004 graduated on time from high school than in 1992 (94% versus 86%). Additionally, a greater proportion of the 2004 high school graduates ever enrolled in any college compared to high school graduates in 1992 (90% versus 88%). Yet a smaller proportion of students that ever enrolled in college enrolled on-time in 2004 compared to 1992 (80% versus 86%). These findings suggest that overall increase in the college enrollment rate in any college in the 2004 cohort was driven by high school graduates who delayed their enrollment into postsecondary education.

There were some subtle differences at the end of the pipeline that translate into moderate differences in college success rates between the cohorts. In the 2004 cohort, 24% of high school seniors earned a bachelor’s degree within six-years of high school graduation through the on-time four-year college pipeline compared to 26% in the 1992 cohort. A greater proportion of students that enrolled on-time enrolled in four-year college on time in 2004 compared to 1992.
However, a smaller proportion of students that enrolled on-time in a four-year college graduated from college within six years in the 2004 cohort than in the 1992 cohort (59% versus 64%). In other words, the six year graduation rate of seniors that enrolled on-time in a four year college declined between 1992 and 2004.

Figure 4.2 focuses on high school graduates who enrolled on-time in postsecondary education. The vast majority of students that ever attended college in both cohorts enrolled on-time, 80% in the ELS:2002 and 86% in the NELS:88. Figure 4.2 shows that approximately two-thirds of students who enrolled on-time in college enrolled in four-year institutions in both the ELS:2002 and NELS:88. As a result, the subsequent sections of the analyses also focused on students who enrolled on-time in four-year institutions.

![Figure 4.2 Distribution of On-time College Enrollees by Type of Postsecondary Institution: High School Graduates in 2004 and 1992.](image)

Note: In the 2004 senior cohort, 80% of college participants enrolled on-time. In the 1992 senior cohort, 86% of college participants enrolled on-time.

Characteristics of On-Time Four-year College Enrollees

Characteristics of the ELS:2002 Analytic Sample

This section describes students in the analytic sample: Seniors who graduated high school on-time, were not missing data on the outcomes of interest, and enrolled in a four-year college on-time. The descriptive statistics displayed in Table 4.1 show the bachelor’s degree completion rates and the means, standard deviations, and rates of missing data for mediator and predictor variables used in analyses related to Research Question 2.

The results describe the outcomes of interest for this study, as well as student, institutional, and state characteristics. The data indicated that the majority of high school graduates who enrolled in a four-year college on-time in the ELS:2002 earned a bachelor’s degree within six years of high school graduation (59%). Students’ college experiences included transfer and full-time/part-time status. Few of the sample students were enrolled part-time at the first institution attended (4%) and approximately 17% transferred institutions at least one time. Students’ academic achievement was measured by their unweighted GPA and SAT scores. The average high school GPA of students in the sample was 3.21 (SD=0.54) and the average SAT score was 1,068 (SD=180.62).12 About one third of this sample were minorities (30%) and slightly less than half were male (45%). Sample members had slightly higher SES than average high school seniors (0.33) and the vast majority (96%) aspired to attain a bachelor’s degree or higher.

Most students enrolled in public institutions (68%). Fewer enrolled in private non-profit institutions (29%), and 3% attended a for-profit school. A typical student attended a four-year college with an enrollment of 11,900 undergraduates and attended an institution with degree

12 Scores of students who took the ACT were converted to SAT scores via a concordance table (ACT, 2011).
related expenditures of $23,620 in 2014 dollars. Average students attended colleges where part-time students made up 17% of the enrollment, minority students made up 27% of the enrollment, and with a student-to-faculty ratio of 14. Students went to high school in states where 41% of the state postsecondary enrollment was in two-year institutions and 18% of state postsecondary enrollment was in private institutions, on average.

**Characteristics of the NELS:88 Analytic Sample**

As shown in Table 4.1, average student outcomes, experiences, background characteristics, and college characteristics for on-time college enrollees in 1992 were different from ELS sample twelve years later. Bachelor’s completion rates among on-time four-year college enrollees in 1992 were higher than they were in 2004 (64% versus 59%, p<.001). In terms of their college experiences, students in 1992 transferred at slightly higher rates (21% versus 17%, p<.001), but slightly fewer attended college part time (3% versus 4%, p<.01). Overall, the students in 1992 had very similar high school academic achievement compared to students in 2004. In 1992, students had slightly lower levels of academic achievement (3.04 versus 3.21 GPA points, p<.001), but average SAT scores were not significantly different from students in 2004.

The student background characteristics were similar in gender balance, but differed in their racial/ethnic background, SES, and educational aspirations. Students in 1992 were less likely to be minority compared to those in 2004 (21% versus 30%, p<.001). College enrollees in 1992 also had higher SES (0.40 versus 0.33, p<.001) compared to those in 2004, and slightly more (6% versus 4%, p<.001) aspired to earn less than a bachelor’s degree.

The college characteristics of an average student were also different in 1992 than in 2004. The same percentage of students attended public institutions, but more attended private
non-profits (32% versus 29%, p<.05) and fewer attended private for-profit schools (0% versus 3%, p<.001). A typical student in 1992 attended a four-year institution with fewer degree related expenditures ($243 million versus $276 million in 2014 dollars, p<.001) per student compared to typical students in 2004. Compared to the 2004, a typical student in 1992 attended schools with smaller enrollment (10,593 versus 11,902 p<.001), more part time students (19% versus 17%, p<.001), and fewer minority students (23% versus 24%, p<.001). In 1992, typical students attended a four-year college larger student to faculty ratios than in 2004 (21 versus 13, p<.001).

Students in 1992 and 2004 went to high school in states that were similar in terms of state postsecondary enrollment in two-year institutions and private institutions.

Table 4.1
Comparison of ELS:2002 4-Year College Analytic Sample Characteristics with NELS:88 4-Year College Analytic Sample Characteristics

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>ELS:2002 4-Year Analytic Sample</th>
<th>NELS:88 4-Year Analytic Sample</th>
<th>Mean Difference</th>
<th>Sig.</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>% Imputed</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Primary Outcome - Degree Attainment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earned a bachelor's within 6 years of HS graduation</td>
<td>0.59</td>
<td>0.49</td>
<td>0.0%</td>
<td>0.64</td>
<td>0.48</td>
</tr>
<tr>
<td>Intermediate Outcomes - College Experiences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transferred</td>
<td>0.17</td>
<td>0.38</td>
<td>0.0%</td>
<td>0.22</td>
<td>0.41</td>
</tr>
<tr>
<td>Part-time enrollment*</td>
<td>0.04</td>
<td>0.20</td>
<td>0.0%</td>
<td>0.03</td>
<td>0.18</td>
</tr>
<tr>
<td>Student Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Achievement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS GPA (0-4.0)</td>
<td>3.21</td>
<td>0.54</td>
<td>6.4%</td>
<td>3.04</td>
<td>0.53</td>
</tr>
<tr>
<td>SAT test score (400-1600)</td>
<td>1,063.27</td>
<td>180.62</td>
<td>8.9%</td>
<td>1,057.57</td>
<td>171.11</td>
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<td>Background Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minority</td>
<td>0.30</td>
<td>0.46</td>
<td>0.0%</td>
<td>0.23</td>
<td>0.42</td>
</tr>
<tr>
<td>Male</td>
<td>0.45</td>
<td>0.50</td>
<td>0.0%</td>
<td>0.46</td>
<td>0.50</td>
</tr>
<tr>
<td>SES**</td>
<td>0.33</td>
<td>0.67</td>
<td>0.0%</td>
<td>0.40</td>
<td>0.70</td>
</tr>
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<td>Educational Aspirations (1-3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than a bachelor's (Ref)</td>
<td>0.04</td>
<td>0.18</td>
<td>-</td>
<td>0.05</td>
<td>0.22</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>0.40</td>
<td>0.49</td>
<td>-</td>
<td>0.43</td>
<td>0.50</td>
</tr>
<tr>
<td>More than a bachelor's</td>
<td>0.57</td>
<td>0.50</td>
<td>-</td>
<td>0.52</td>
<td>0.50</td>
</tr>
<tr>
<td>Institutional Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control (1-3)</td>
<td>0.68</td>
<td>0.47</td>
<td>-</td>
<td>0.67</td>
<td>0.47</td>
</tr>
<tr>
<td>Public (Ref)</td>
<td>0.29</td>
<td>0.46</td>
<td>-</td>
<td>0.33</td>
<td>0.47</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0.03</td>
<td>0.16</td>
<td>-</td>
<td>0.00</td>
<td>0.07</td>
</tr>
<tr>
<td>Private for-profit</td>
<td>0.00</td>
<td>0.00</td>
<td>-</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total enrollment</td>
<td>11,902.25</td>
<td>9,981.21</td>
<td>0.8%</td>
<td>10,455.34</td>
<td>8,492.96</td>
</tr>
<tr>
<td>Degree related expenditures (in millions $)**</td>
<td>7.31</td>
<td>6.25</td>
<td>4.0%</td>
<td>7.00</td>
<td>6.35</td>
</tr>
<tr>
<td>Degree related expenditures per student (in thousands $)**</td>
<td>2.62</td>
<td>2.45</td>
<td>1.4%</td>
<td>2.62</td>
<td>2.50</td>
</tr>
<tr>
<td>Percentage of undergraduates that are part-time</td>
<td>0.17</td>
<td>0.14</td>
<td>0.0%</td>
<td>0.18</td>
<td>0.14</td>
</tr>
<tr>
<td>Percentage of undergraduates that are minority</td>
<td>0.27</td>
<td>0.22</td>
<td>0.8%</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>Student-to-faculty ratio</td>
<td>13.30</td>
<td>6.80</td>
<td>46.7%</td>
<td>20.94</td>
<td>8.71</td>
</tr>
<tr>
<td>State Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of state PSE enrollment in 2-year institutions</td>
<td>0.41</td>
<td>0.12</td>
<td>0.1%</td>
<td>0.41</td>
<td>0.13</td>
</tr>
<tr>
<td>Percent of state PSE enrollment in private institutions</td>
<td>0.18</td>
<td>0.10</td>
<td>0.1%</td>
<td>0.19</td>
<td>0.11</td>
</tr>
</tbody>
</table>

* p<.05  ** p<.01  *** p<.001. Notes: Analytic sample consists of on-time 4-year college enrollees with complete outcome data. Sample N is unweighted, Mean and SD are weighted. (a) Enrolled part-time at the first institution the student attended. (b) SES is standardized on the full sample of high school seniors. (c) 2014 dollars. Sources: National Center for Education Statistics, Education Longitudinal Study of 2002; National Education Longitudinal Study of 1988.
**College Experiences of 2004 High School Graduates who Enroll in College On-Time**

Focusing on the most recent data, the ELS: 2002, Figure 4.3 portrays the college experiences for students who enrolled in a four-year institution on-time. Combined into a two-by-two matrix, these two college experiences create four distinct types of college experiences — (1) those who have initially enrolled full-time in a four-year institution and never transferred to another postsecondary institution (2) full-time students who transferred from their initial college to another postsecondary institution one or more times, (3) those who initially enrolled part-time in a four-year institution and never transferred to another institution, and (4) those who initially enrolled part-time in a four-year institution and subsequently transferred to another postsecondary institution.

**Figure 4.3 Types of college experiences of 2004 senior cohort members who enrolled on-time in a four-year institution.**

Note: 1.2 million students enrolled on-time in a four-year institution (unweighted N = 5,530).

Figure 4.3 shows that these types of experiences were not equally occurring. The most common type of experience for on-time four-year college enrollees was attending one institution full-time (80%), followed by enrolling full-time in a four-year institution and subsequently transferring to another postsecondary institution (16%), initially enrolling part-time in a four-year institution and never transferring (3%), and both enrolling part-time and then transferring to another college(1%).

![Pie chart showing college experience types.]

Figure 4.4 Percentage of total bachelor’s degrees earned by type of college experience for 2004 senior cohort members who enrolled on-time in four-year institutions. Note: Nationally it is estimated that 691,990 students who enrolled on-time in a four-year institution earned a bachelor’s degree within six years (unweighted N = 3,300). Source: National Center for Education Statistics, Education Longitudinal Study of 2002.

Of all types of college experiences, attending one institution full-time and transferring appeared to be the most common for bachelor’s degree completion. Students who attended one institution full-time and students who transferred earned 99% of bachelor’s received by on-
time enrollees in four-year colleges and universities. Figure 4.4 shows that 88% of bachelor’s
degrees were earned by students who attended one institution full-time, and 11% of all
bachelor’s degrees were earned by students who transferred at least once.

**Characteristics of Students from the 2004 Cohort with Different College Experiences**

The educational attainment and academic achievement of students across the four
types of college experience varied, as shown in Table 4.2. Students who attended one
institution full-time, had the highest bachelor’s degree completion rates (65%). Furthermore,
they also had substantially higher high school GPAs (3.26), and SAT scores (1081). Transfer
students graduated at lower rates (40%), and had lower high school GPAs (3.06) and SAT scores
(1,010). Overall, part-time students who did not transfer had the lowest bachelor’s completion
rates (12%) and levels of academic achievement (2.69 GPA and 906 SAT score).

Table 4.2 indicates that the background characteristics of students with different college
experiences also varied. Students who attended one institution full-time were more likely than
students in the other three categories to have a higher SES (0.36), be female (55%), be white
(71%), and have higher educational aspirations (59% aspired to more than a bachelor’s degree).
Transfer students were the most likely to be female (57%), and had lower SES (0.24) and
educational aspirations (51% aspired to more than a bachelor’s degree) than students who
attended one institution full-time. Part-time students who did not transfer were more likely to
be men (57%) and minorities (38%), lower SES (-0.01), and have lower educational aspirations
(36% aspired to more than a bachelor’s).
### Table 4.2

Comparison of ELS:2002 4-Year College Analytic Sample Characteristics with By Type of Student: Attended One Institution Full-time, Transferred, Enrolled Part-time, Transferred and Enrolled Part-time

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Analytic Sample</th>
<th>Attended One Institution Full-time</th>
<th>Transferred</th>
<th>Enrolled Part-time w/o Transfer</th>
<th>Transferred and Enrolled Part-time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>% Imputed</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Primary Outcome - Degree Attainment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earned a bachelor's within 6 years of HS graduation</td>
<td>0.59</td>
<td>0.49</td>
<td>0.0%</td>
<td>0.65</td>
<td>0.48</td>
</tr>
<tr>
<td>Intermediate Outcomes - College Experiences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transferred</td>
<td>0.17</td>
<td>0.38</td>
<td>0.0%</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Part-time enrollment</td>
<td>0.04</td>
<td>0.20</td>
<td>0.0%</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Student Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS GPA (0-4.0)</td>
<td>3.21</td>
<td>0.54</td>
<td>6.4%</td>
<td>3.26</td>
<td>0.52</td>
</tr>
<tr>
<td>SAT Test score (400-1600)</td>
<td>1,063.27</td>
<td>180.62</td>
<td>8.9%</td>
<td>1,081.48</td>
<td>177.83</td>
</tr>
<tr>
<td>Background Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minority</td>
<td>0.30</td>
<td>0.46</td>
<td>0.0%</td>
<td>0.29</td>
<td>0.46</td>
</tr>
<tr>
<td>Male</td>
<td>0.45</td>
<td>0.50</td>
<td>0.0%</td>
<td>0.45</td>
<td>0.50</td>
</tr>
<tr>
<td>SES*</td>
<td>0.33</td>
<td>0.67</td>
<td>0.0%</td>
<td>0.36</td>
<td>0.68</td>
</tr>
<tr>
<td>Educational Aspirations (1-3)</td>
<td>8.7%</td>
<td>8.6%</td>
<td>12.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than a bachelor's (Ref)</td>
<td>0.04</td>
<td>0.18</td>
<td>-</td>
<td>0.03</td>
<td>0.17</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>0.40</td>
<td>0.49</td>
<td>-</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>More than a bachelor's</td>
<td>0.57</td>
<td>0.50</td>
<td>-</td>
<td>0.59</td>
<td>0.49</td>
</tr>
<tr>
<td>Control (1-3)</td>
<td>0.01</td>
<td></td>
<td>0.09</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Public (Ref)</td>
<td>0.08</td>
<td>0.47</td>
<td>-</td>
<td>0.08</td>
<td>0.47</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0.29</td>
<td>0.46</td>
<td>-</td>
<td>0.30</td>
<td>0.46</td>
</tr>
<tr>
<td>Private for-profit</td>
<td>0.03</td>
<td>0.36</td>
<td>-</td>
<td>0.02</td>
<td>0.15</td>
</tr>
<tr>
<td>Total enrollment</td>
<td>11,902.25</td>
<td>9,981.21</td>
<td>0.08%</td>
<td>12,107.75</td>
<td>9,863.83</td>
</tr>
<tr>
<td>Degree related expenditures (in millions $)^d</td>
<td>276.39</td>
<td>324.30</td>
<td>2.4%</td>
<td>297.71</td>
<td>339.90</td>
</tr>
<tr>
<td>Degree related expenditures per student (in thousands $)^d</td>
<td>26.52</td>
<td>26.11</td>
<td>2.4%</td>
<td>25.21</td>
<td>27.97</td>
</tr>
<tr>
<td>Percentage of undergraduates that are part-time</td>
<td>0.17</td>
<td>0.14</td>
<td>2.0%</td>
<td>0.16</td>
<td>0.13</td>
</tr>
<tr>
<td>Percentage of undergraduates that are minority</td>
<td>0.27</td>
<td>0.22</td>
<td>0.8%</td>
<td>0.27</td>
<td>0.22</td>
</tr>
<tr>
<td>Student-to-faculty ratio</td>
<td>13.30</td>
<td>8.80</td>
<td>46.7%</td>
<td>13.06</td>
<td>6.27</td>
</tr>
<tr>
<td>State Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of state PSE* in 2-year institutions</td>
<td>0.41</td>
<td>0.12</td>
<td>0.1%</td>
<td>0.41</td>
<td>0.12</td>
</tr>
<tr>
<td>Percent of state PSE* in private institutions</td>
<td>0.10</td>
<td>0.10</td>
<td>0.1%</td>
<td>0.18</td>
<td>0.10</td>
</tr>
<tr>
<td>Sample N</td>
<td>5,351</td>
<td>3,416</td>
<td>831</td>
<td>159</td>
<td>45</td>
</tr>
</tbody>
</table>

Notes: Analytic sample consists of on-time 4-year college enrollees with complete outcome data. Sample N is unweighted, Mean and SD are weighted. (a) Enrolled part-time at the first institution the student attended. (b) SES is standardized on the full sample of high school seniors. (c) 2014 dollars. (d) Postsecondary enrollment. Source: National Center for Education Statistics, Education Longitudinal Study of 2002.
Lastly, the institutions students’ attended differed depending on students’ college experiences. Students who attended one institution full-time were most likely to attend institutions where smaller shares of the student body were enrolled part-time (0.16). Average students attending one institution full-time and average transfer students attended schools where minority students composed 27% of the student body and had student-to-faculty ratios of 13 to 1. Average transfer students attended schools with the smallest undergraduate enrollment (10,695). Average part-timers were more likely to attend a public institution (80%), schools with larger undergraduate enrollments (12,372) and schools that had fewer degree related expenditures per student ($12,130) compared to the other groups. They also attended institutions where larger shares of the student body were enrolled part-time (34%), minority students (30%), and with larger student to faculty ratios (18) compared to the other groups.

Receiving Institutions of Students Transferring from Four-Year Colleges in the 2004 Cohort

This section examines students in the 2004 cohort who transferred from four-year institutions. First, I analyze the types of institutions where transfer students initially began their college career and the institutions to which they eventually moved. Then I analyze the distribution of receiving institutions based on the first institution attended. These analyses show that four-year students transfer to a variety of institutions and the type of institution students’ transfer to depends, in part, on the type of institution they first attend.

Table 4.3 shows the initial institution transfer students attended. According to the ELS:2002 cohort data, 66% of students who transferred initially attended public institutions, 31% initially attended private non-profit institutions, and 2% initially attended private for-profit institutions. Transfer students tended to move to public 2-year institutions (47%), followed by public 4-year institutions (35%), and private non-profit 4-year institutions (12%). About 7% of
students transferred to for-profit institutions, private two-year schools, or less-than-two-year schools.

Table 4.3

*First and Second Institution Attended of Full-Time Students who Initially Enrolled On-Time in 4-Year College and Subsequently Transferred*

<table>
<thead>
<tr>
<th>First Institution Attended</th>
<th>%</th>
<th>Second Institution Attended</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public 4-Year</td>
<td>67</td>
<td>Public 4-Year</td>
<td>35</td>
</tr>
<tr>
<td>Private Non-Profit 4-Year</td>
<td>31</td>
<td>Private Non-Profit 4-Year</td>
<td>12</td>
</tr>
<tr>
<td>Private For-Profit 4-Year</td>
<td>3</td>
<td>Private For-Profit 4-Year</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Public 2-Year</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private For-Profit 2-Year</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private For-Profit Less-than-2-Year</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Public Less-than-2-Year</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Missing</td>
<td>1</td>
</tr>
</tbody>
</table>

Sample N 880 880

Notes: Analytic sample consists of on-time 4-year college enrollees with complete outcome data. Full-time students who transferred from their initial college to another postsecondary institution composed 16% of the analytic sample. Sample N is unweighted, percentages are weighted. Percentages may not total 100 due to rounding. Sources: National Center for Education Statistics, Education Longitudinal Study of 2002.

Further investigation into the data demonstrates that the pattern of transferring differs by first institution attended. Students who started in public 4-year, private non-profit 4-year, and private for-profit 4-year institutions generally transferred to different types of colleges.

Figure 4.5 depicts the first institution which students attended and the sector of the subsequent institution they attended. Students who started college in public 4-year colleges were most likely to transfer to public 2-year institutions (51%), followed by public 4-year institutions (34%), private non-profit 4-year institutions (8%), and private for-profit 4-year institutions (2%). Those who began in private non-profit 4-year institutions were mostly likely to transfer to public 4-year
institutions (39%), followed by public 2-year institutions (36%), private non-profit 4-year institutions (20%), and private for-profit 4-year institutions (3%). Students who began in private for-profit 4-year institutions were mostly likely to transfer to schools in the public 2-year sector (53%) followed by the public 4-year sector (22%), private for-profit 4-year sector (14%) and the private non-profit 4-year sector (7%).

Figure 4.5. Distribution of second institution attended for full-time students who enrolled on-time in four-year institutions, by first institution attended.

Note: Nationally it is estimated that 201,180 full-time students who enrolled on-time in a four-year institution transferred colleges within two-years (unweighted N = 880).


In summary, the findings from Research Question #1 indicated that the college pipeline has stayed relatively stable over time as have the characteristics of students who enrolled in
college on-time. In the 2004 cohort, students with different characteristic had distinct college experiences. Students who transferred colleges were most likely to move to public 2-year schools, followed by public 4-year institutions. Where students transferred depended upon where students started. In the next section, I describe the findings from the logistic regression analyses used to model the relationships between student factors and bachelor’s degree completion.

**Research Question #2**

*What is the relationship between bachelor’s degree completion and high school academic achievement within six years for students from the 2004 senior cohort enrolling on-time at four-year colleges?*

In this section, I describe the results from a series of logistic regression models that estimate the relationship between bachelor’s degree completion in six-years and academic achievement. I also describe the results from logistic regression models of transfer status on academic achievement. For both sets of models, I used the ELS:2002 analytic sample and conducted a series of staged regression analysis, with each step controlling for additional potential confounding variables—student background characteristics, college, and state characteristics. The analyses proceed in three steps examining 1) bachelor’s degree completion and academic achievement; 2) transferring and academic achievement; and 3) bachelor’s degree completion and academic achievement, controlling for transferring. The results will be
used in Research Question #3 to create a path model that partitions the direct and indirect effects of academic resources on bachelor’s degree completion, controlling for other factors.\textsuperscript{13}

**Step 1**

Step 1 provided a baseline for the relationship between academic achievement, student background, college, and state characteristics and college completion. Model 1 included both high school GPA and SAT score together to predict completion.\textsuperscript{14} Model 2 added student background controls to the academic achievement predictors. Model 3 included controls for college characteristics and state characteristics. Table 4.4 contains the results from Step 1.

In Model 1, high school GPA and SAT scores GPA both had positive, significant relationships with bachelor’s degree completion (p<.001). A one standard deviation increase in high school GPA was associated with 91% higher odds of completing a bachelor’s degree, after controlling for SAT score. Controlling for high school GPA, a one standard deviation increase in SAT score was associated with 61% higher odds of completing a bachelor’s degree. A comparison of the AICc and pseudo $R^2$ statistics indicated that including high school GPA and SAT score improved model fit and predictive ability compared to the intercept-only model.

In Model 2, I controlled for student demographic characteristics such as minority status, gender, and SES, as well as educational aspirations. Including these variables improved the model fit and changed the GPA and test score parameter estimates. The test score parameter estimate decreased from 61% to 44% higher odds, which is outside of the boundary of its 95%

\textsuperscript{13} Prior to beginning the analyses high school GPA and SAT scores were standardized on the analytic sample so the magnitudes of their effects would be comparable.

\textsuperscript{14} Appendix E reports results for bivariate regressions of bachelor's degree completion on high school GPA and SAT score. Bivariate regression results show that, by themselves, GPA and test scores are related to bachelor's degree completion, where a one standard deviation increase results in a 137% and 118% increases in the odds of earning a bachelor's degree within six years, respectively. Comparisons of the AICc and Pseudo $R^2$ statistics showed that the model including GPA fits the data better than the highest test score model.
<table>
<thead>
<tr>
<th>Table 4.4</th>
<th>Logistic Regression Results for Bachelor's Degree Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Marginal Effect</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.20</td>
</tr>
<tr>
<td>Academic Achievement</td>
<td></td>
</tr>
<tr>
<td>HS GPA</td>
<td>0.16</td>
</tr>
<tr>
<td>SAT score</td>
<td>0.11</td>
</tr>
<tr>
<td>Student Characteristics</td>
<td></td>
</tr>
<tr>
<td>Minority</td>
<td>0.01</td>
</tr>
<tr>
<td>Male</td>
<td>-0.01</td>
</tr>
<tr>
<td>SES</td>
<td>0.09</td>
</tr>
<tr>
<td>Educational aspirations</td>
<td></td>
</tr>
<tr>
<td>Bachelor's (ref. less than a bachelor's)</td>
<td>0.09</td>
</tr>
<tr>
<td>More than a bachelor's (ref. less than a bachelor's)</td>
<td>0.08</td>
</tr>
<tr>
<td>College Characteristics</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Private non-profit (ref. public)</td>
<td></td>
</tr>
<tr>
<td>Private for-profit (ref. public)</td>
<td>-0.10</td>
</tr>
<tr>
<td>Total enrollment (in thousands)</td>
<td>0.00</td>
</tr>
<tr>
<td>Degree-related expenditures per student (in thousands $)</td>
<td>0.00</td>
</tr>
<tr>
<td>Student/faculty ratio</td>
<td>-0.01</td>
</tr>
<tr>
<td>Percentage of undergraduates that are minority</td>
<td>0.00</td>
</tr>
<tr>
<td>Percentage of undergraduates that are part-time</td>
<td>0.00</td>
</tr>
<tr>
<td>State Characteristics</td>
<td></td>
</tr>
<tr>
<td>Percent of state PSE in two-year colleges</td>
<td>1.250</td>
</tr>
<tr>
<td>Psuedo R²</td>
<td>0.13</td>
</tr>
<tr>
<td>AICc</td>
<td>6,756.53</td>
</tr>
<tr>
<td>Error Rate</td>
<td>0.30</td>
</tr>
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</tr>
<tr>
<td>Specificity</td>
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</table>

Notes: (a) The marginal effects represent the change in the probability of completion for a 1 unit increase in X, for individuals with an average probability of completion (0.59). (b) SES is standardized on the full sample of high school seniors. (c) Postsecondary enrollment. (d) AICc is a model fit statistic that corrects for sample size and the number of covariates, smaller is better. (e) The error rate is the percentage of predictions that are incorrect. The percentage decrease in error rate is obtained by comparing the error rate for a particular model with the error rate for the intercept only model. (f) Sensitivity is the proportion of bachelor's degree completers which are correctly identified. (g) Specificity is the proportion of those who did not complete a bachelor's who are correctly identified.

confidence interval from Model 1. Conversely, the parameter estimate for GPA increased from 91% to 96% higher odds, but this increase is within its 95% confidence interval from Model 1. The changes in the test score coefficient suggest that student background variables explained a larger portion of the SAT score/completion relationship than the GPA/completion relationship.

Of the additional student characteristics added in Model 2, SES and educational aspirations were statistically significant. After controlling for the other factors in the model, students with one standard deviation higher SES had 43% greater odds (p<.001) of completing a bachelor’s degree within six years of high school graduation. Additionally, students who aspired to earn a bachelor’s degree or higher, compared to those with aspirations of less than a bachelor’s degree, had significantly higher odds of completing a degree. Minority status and gender were not significant predictors of completion after holding other factors constant.

Model 3 included college and state characteristics. Including these predictors reduced the size of the coefficient on SAT score from 44% to 27% higher odds, again outside of the 95% confidence interval from Model 2. The coefficient on GPA increased slightly from 96% to 97% higher odds. Including college and state characteristics also slightly reduced the coefficient on SES from 43% to 40% higher odds and completely accounted for the relationship between educational aspirations and completion. Model 3 had the best fit of all models according to the AICc and pseudo R² statistics.

Of the college and state characteristics, private for-profit control, the institution's student-to-faculty ratio, percentage of part-time students, and the percent of state enrollment in two-year colleges and in private colleges were all statistically significant (p<.001) after controlling for other factors. Compared to public institutions, students attending private-for-profit institutions have a 35% lower odds of completion. A one unit increase in the student-to-
faculty ratio was associated with 3% lower odds of completion. A one percentage point increase in part-time students enrolled at an institution was associated with 2% lower odds of completion. A one percentage point increase in state enrollment in two-year colleges and private institutions was associated with a 1% and 2% higher odd, respectively. Although the college and state characteristics had statistically significant relationships with completion, their practical significance was minimal. With the exception of attending a for-profit institution, the marginal effects of the college and state characteristics were qualitatively small compared to student characteristics.

In summary, I found that high school GPA and SAT scores were strong predictors of college completion after controlling for student and college background characteristics. Higher GPA and higher test scores led to higher odds of completing a bachelor’s degree within six years. However, the relationship between GPA and completion was stronger than the relationship between SAT score and completion. SES and college characteristics also predicted completion—the more family and college resources higher the odds of earning a bachelor’s degree. SES also explained a portion of the SAT/completion relationship, but not the GPA/completion relationship. There were no differences in the odds of completion between minorities and whites or between students in public and private institutions after accounting for academic achievement, background, and institutional characteristics.

**Step 2**

This step estimated the relationship between student academic achievement, background characteristics, college, and state characteristics and the intermediate outcome of transferring institutions at least once. I used the same model sequence to analyze the relationships between academic achievement, other background characteristics, and transfer as
I did in Step 1. In the first model, I combined both high school GPA and SAT scores to examine their unique contributions. Controls for high school background characteristics were included in Model 2, and Model 3 expanded on the controls by adding college and state characteristics. Results are reported in Table 4.5.

Results from Model 1 showed that high school GPA and SAT test score significantly predicted transferring ($p<.001$). A one standard deviation increase in high school GPA was associated with 17% lower odds of transferring ($p<.001$), controlling for SAT score. Controlling for high school GPA, a one standard deviation increase in SAT score was associated with 24% lower odds of transferring ($p<.001$). That is, students with higher academic achievement were more likely to remain at the first institution they attended. A comparison of the AICc and pseudo $R^2$ statistics indicated that including high school GPA and SAT score slightly improved model fit and predictive ability compared to the intercept-only model.

When student background characteristics were included in Model 2 the parameter estimate for high school GPA changed slightly from 17% to 20% lower odds, while the estimate for SAT score remained the same. Additionally, the minority indicator was statistically significant ($p<.001$), demonstrating that minority students have 27% lower odds of transferring compared to white students, after accounting for other characteristics. Compared to female students, male students had 12% lower odds of transferring ($p<.10$), controlling for other factors. Including student background characteristics slightly reduced the AICc statistic, but did not change the pseudo $R^2$, compared to Model 1.

Including college and state characteristics in Model 3 reduced the parameter estimate for SAT score from 24% to 22% lower odds of transferring per standard deviation increase and
<table>
<thead>
<tr>
<th>Table 4.5</th>
<th>Logistic Regression results for Transferring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
</tr>
<tr>
<td></td>
<td>Marginal Effect</td>
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<td>Academic Achievement</td>
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<td>HS GPA</td>
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<td>SAT score</td>
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<td>Student Characteristics</td>
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<td>SESb</td>
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<td>Control</td>
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<td>Private non-profit (ref. public)</td>
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<td>Private for-profit (ref. public)</td>
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<td>Total enrollment (in thousands)</td>
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<td>Degree-related expenditures per student (in thousands $)</td>
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<td>Student/ faculty ratio</td>
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</tr>
<tr>
<td>Percentage of undergraduates that are minority</td>
<td></td>
</tr>
<tr>
<td>Percentage of undergraduates that are part-time</td>
<td></td>
</tr>
<tr>
<td>College Characteristics</td>
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<td>College Characteristics</td>
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<td>Percent of state PSE in two-year colleges</td>
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<td>AICc⁶</td>
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<tr>
<td>Error Rate</td>
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</tr>
<tr>
<td>% decrease in error rate⁷</td>
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<tr>
<td>Sensitivity⁸</td>
<td>1.00</td>
</tr>
<tr>
<td>Specificity⁹</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*p<.10. **p<.05. ***p<.01. ****p<.001. Notes: (a) The marginal effects represent the change in the probability of transferring for a 1 unit increase in X, for individuals with an average probability of transferring 0.17. (b) SES is standardized on the full sample of high school seniors. (c) Postsecondary enrollment. (d) AICc is a model fit statistic that corrects for sample size and the number of covariates, smaller is better. (e) The error rate is the percentage of predictions that are incorrect. The percentage decrease in error rate is obtained by comparing the error rate for a particular model with the error rate for the intercept only model. (f) Sensitivity is the proportion of bachelor’s degree completers which are correctly identified. (g) Specificity is the proportion of those who did not complete a bachelor’s which are correctly identified. Source: National Center for Education Statistics, Education Longitudinal Study of 2002.
the parameter estimate for GPA did not change. The estimate for minority students also decreased from 27% to 23% lower odds of transferring, compared to whites. Students attending private non-profit institutions were more likely to transfer compared to students attending public institutions (p<.05). The student-to-faculty ratio and degree related expenditures per student were also found to have a negative relationships with transferring (p<.001), but the relationship were practically small. Controlling for other factors, a one thousand dollar increase in expenditures is related to a 2% lower odds of transferring and a one unit increase in the student to faculty ratio is associated with 5% lower odds of transferring. The Model 5 fit the data the best out of all according to the AICc statistic, but the Pseudo R² changed by only 0.01 points compared to the intercept-only model.

Step 2 demonstrated that academic resources predicted transferring. Students with higher levels of academic achievement were less likely to transfer. Additionally, controlling for student background, college, and state characteristics did not explain meaningful portions of the relationship between academic achievement and college experiences. Minority students and male students were significantly less likely to transfer than white students, controlling for other factors. Finally, students from private non-profit institutions were more likely to transfer than students at public institutions, after controlling for other factors.

**Step 3**

Step 3 identifies the direct relationships between student academic achievement, high school background factors, college factors, and state factors, net of their effects through transferring. This step builds on Step 1, Model 3, where I modeled bachelor's degree completion controlling for the full set of student academic resources, background characteristics, college characteristics, and state characteristics. In Step 3, I include the
intermediate outcome of transfer and test if including transfer as a predictor resulted in any changes to the academic achievement parameters.

The results, as pictured in Table 4.6 showed that the experience of transferring was a significant predictor of college completion. Controlling for all other variables, students who
transferred had a 54% lower odds (p<.001) of earning a bachelor’s in six years compared to those who did not transfer. After including transfer as a predictor, the parameter estimates of GPA and SAT score decreased from 97% to 93% higher odds and from 27% to 24% higher odds, respectively. Estimates for percent of undergraduates that are part-time, private for-profit institutions, and student-to- faculty ratio also changed slightly to reflect lower odds of completion.

In summary, Step 3 illustrates that the components of academic achievement are large, significant predictors of bachelor’s degree completion compared to other variables. Controlling for the college experience of transferring did not produce meaningful changes in the completion/GPA and completion/SAT score relationship. This result suggests that college transferring is a weak mediator of the completion/academic achievement relationship.

**Research Question #3**

**To what extent does transferring colleges mediate the relationship between bachelor’s degree completion and high school academic achievement within six years for students in the 2004 senior cohort?**

In this section, I combine the results of the regression models to create a path analysis as described in Chapter 3. Using path analysis, the total effects of academic achievement can be separated into direct and indirect effects. The path analysis reveals if the components of academic achievement on their own are directly related to completion (i.e. direct effects), or if transferring is the mechanism by which academic achievement measures are related to completion (i.e. indirect effects). Figure 4.6 depicts the hypothesized path by which academic achievement affects bachelor’s degree completion, after controlling for student background, college, and state characteristics. First, I use the results from the regression models in the
previous section to identify the total effect of high school GPA and SAT scores on bachelor’s degree completion. Second, I use the results from the previous section to calculate the direct and indirect effects of high school GPA and SAT scores on bachelor’s degree completion. Lastly, I partition the total effect of high school GPA and SAT scores on bachelor’s degree completion into their direct and indirect (via transferring) effect on bachelor’s degree completion.

**Total Effect**

To identify the total effect I use the results from Model 1 from Step 3, the regression of the bachelor’s completion in six years on student academic achievement and the controls variables, before accounting for transfer. This model estimates the total effect of academic achievement, controlling for other factors. For example, the coefficient on GPA from Model 1, Step 3 is interpreted as the change in the odds of completing a bachelor’s degree in six years for a one standard deviation change in GPA, controlling for test score, background, college, and state characteristics.

Figure 4.6 depicts the three sets of relationships needed to partition the total effects into direct and indirect effects. They are:

1. The relationships between the academic achievement and transfer (i.e. the mediating variable).
2. The relationships between transferring and bachelor’s degree completion.
3. The direct relationship between academic achievement and bachelor’s degree completion.

The direct effects of academic achievement are depicted via the horizontal line connecting high school GPA and SAT score to bachelor’s completion. The indirect effects follow the lines from the academic achievement variables, through transfer, and on to bachelor’s
completion. Results of the path analysis are also presented in Table 4.7.

Figure 4.6. Path analysis of the direct and indirect effects of academic achievement on bachelor’s degree completion through the transfer pathway.

Note: Estimates shown control for student background, college, and state characteristics (not pictured).

Table 4.7

Model Estimates for the Path Analysis of Academic Achievement\(^a\)

<table>
<thead>
<tr>
<th>Antecedent</th>
<th>(M_1) (Transfer)</th>
<th>(Y) (Bachelor’s Degree)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
</tr>
<tr>
<td>(X_1) (HS GPA)</td>
<td>(a_1)</td>
<td>-0.12***</td>
</tr>
<tr>
<td>(X_2) (SAT score)</td>
<td>(a_2)</td>
<td>-0.13***</td>
</tr>
<tr>
<td>(M_1) (Transfer)</td>
<td>(b_1)</td>
<td>-0.16***</td>
</tr>
</tbody>
</table>

Note: \(\sim p<.10. \; *p<.05. \; **p<.01. \; ***p<.001.\) (a) Coefficients are standardized and reported in log odds. Results have been adjusted for path analysis with dichotomous mediators and outcomes (Kenny, 2013; Mackinnon & Dwyer, 1993). Estimates shown control for student background, college, and state characteristics. (b) Total effect of GPA \(C_{gpa} = 0.35***\) (c) Total effect of Test score \(C_{test} = 0.13***\).

**Interpretation of the Path Analysis**

*Indirect Effects*

As can be seen in Figure 4.6 and Table 4.7, one standard deviation increases in high school GPA and SAT score were negatively related to transferring, and transferring was negatively related to completing a bachelor’s degree. Each component of academic achievement has a positive indirect effect on college completion that operates through the transfer pathway.

High school GPA had a small, positive indirect effect when operating through transfer. The indirect effect encompasses the pathways from GPA to transfer and from transfer to completion, both of which are negative. Because students with higher GPAs were less likely to transfer, and transfers students are less likely to complete, the indirect effect of GPA through the transfer pathway is positive. The magnitude of the indirect effect was calculated by multiplying the coefficients for each of the path sections (from GPA to transfer and from transfer to the outcome). Students with one standard deviation higher GPAs were less likely to transfer than those with lower GPAs \((a_1 = -0.12, p<.001)\), and students who transfer were less likely to earn a bachelor’s degree within six years of high school graduation \((b_1 = -0.16, p<.001)\). All else being equal, those students with one standard deviation higher GPAs were significantly more likely \((a_1b_1 = 0.02, 95\% \text{ CI} [0.03, 0.01])\) to earn a bachelor’s degree within six years of high school graduation as a result of GPA’s effect on staying at one institution which, in turn, positively affected completion.

SAT score also has a small, positive indirect effect when operating transfer. The magnitude of the indirect effect was calculated by multiplying the coefficients for each of the path sections (from SAT test score to transfer and from transfer to the outcome). Students with
one standard deviation higher SAT scores were less likely to transfer than those with lower test scores ($a_2 = -0.13$, $p<.001$), and students who transfer were less likely to earn a bachelor’s degree within six years of high school graduation ($b_1 = -0.16$, $p<.001$). All else being equal, those students with one standard deviation higher SAT scores were significantly more likely ($a_2b_1 = 0.02$, 95% CI [0.03, 0.01]) to earn a bachelor’s degree within six years of high school graduation as a result of tests score’s effect on staying at one institution which, in turn, positively affected completion.

**Direct Effects**

The results also indicated that high school GPA and SAT score had positive direct effects on completion independently of their effects through the transfer pathway ($c'_{gpa} = 0.34$, $p = <.001$; $c'_{test} = .12$, $p = <.001$). In other words, students with one standard deviation higher high school GPAs were more likely to earn a bachelor’s degree after controlling for SAT score, transfer status, student background, college, and state characteristics into consideration. Furthermore, students with one standard deviation higher SAT scores were more likely to earn a bachelor’s degree after taking into account high school GPA and the other factors.

Overall, both high school GPA and SAT score had positive, significant direct relationships with collect completion. High school GPA had a larger direct effect on college completion than SAT score, controlling for other variables. Transfer was a significant mediator of the relationship between academic achievement and completion, but it did not completely mediate the relationship. About 6% of the total effect of GPA was mediated by transfer, compared to 15% of the total effect of SAT. The results indicate that transfer is not the only pathway by which academic achievement is related to bachelor’s degree completion.
Chapter 5

CONCLUSION

This chapter reviews the purpose and findings from this study, as well as discusses their implications for policy, practice, and future research. The purpose of this dissertation was to examine the changes (or lack thereof) in the college pipeline and to analyze the relationship between high school academic achievement and bachelor’s degree completion for students enrolling on-time in four-year institutions. The objectives of the study were to:

1. Examine if the education pipeline leading to bachelor’s degree completion has changed over time, if the characteristics of students enrolling on-time in a four-year institutions have changed, and if students’ characteristics differ by college experience;

2. Explore the relationship between bachelor’s degree completion and high school academic achievement after accounting student, institutional, and state characteristics and student experiences in college; and

3. Examine to what extent the experience of transferring colleges mediates the bachelor’s degree completion/academic achievement relationship.

In the second chapter, I reviewed the literature on predictors of college completion and found that there are very few studies of changes in the education pipeline and the population of students enrolling in four-year colleges over time. However, I did find a theoretical literature and empirical research on the relationship between college completion and student, institutional, and state factors. I based my conceptual model on this literature. The conceptual model illustrates that college experiences mediate the relationship between college completion
and student-level factors like academic achievement. However, I could not find any studies that tested to what extent college experiences like transfer mediated the relationship between college completion and high school academic achievement. This dissertation is the first to address this gap.

The third chapter outlined the data, sample, and analytic methods used in this study. Utilizing data from two nationally representative, longitudinal studies of high school students (ELS:2002 and NELS:88), I planned to first describe the college pipeline and the population of on-time four-year college enrollees over time, then create a series of logistic regression models which test the relationship between bachelor’s degree completion and academic achievement.

The fourth chapter addressed each of the three research objectives. I conducted a descriptive analysis of the college pipeline for high school seniors in the ELS:2002 and NELS:88, a descriptive comparison of the population of on-time four-year college enrollees from 2004 and 1992, and examined the college experiences of students from the 2004 cohort that enrolled on-time in a four-year college. I also conducted a series of logistic regressions that modeled the relationship between bachelor’s degree completion and academic achievement. The results of the regression models were used to construct a path analysis that decomposed the relationship between academic achievement and bachelor’s degree completion into the direct and indirect components via the transfer pathway. The results of the analyses are highlighted below.

Summary of Findings and their Implications

*The 2004 senior cohort had a lower six year graduation rate, but earned more bachelor’s degrees overall, compared to the 1992 senior cohort.* The college pipeline shows changes between 1992 and 2004. A larger number of students were high school seniors in 2004 (2.8
million) than in 1992 (2.5 million). A greater percentage of high school seniors in the 2004 senior cohort graduated high school compared to the 1992 senior cohort (94% versus 86%). A greater percentage of the 2004 senior cohort eventually enrolled in college (90% versus 88%). However, a smaller percentage of the 2004 senior cohort enrolled in college on-time compared to the 1992 cohort (80% versus 86%), which implies an increase in share of students in the later cohort delaying enrollment. Of students that enrolled in college on-time, a larger percentage of the 2004 senior cohort enrolled in four-year institutions (67% versus 63%), but a smaller percentage graduated within six years (59% versus 64%). Despite the lower graduation rate, more students from the 2004 senior cohort earned a bachelor’s degree than in the 1992 senior cohort (672,000 versus 650,000).

The characteristics of students enrolling on-time in a four year college changed between 1992 and 2004. Descriptive analyses suggested that on-time four-year college enrollees from the 2004 senior cohort had different college experiences, academic preparation, and background characteristics than the 1992 senior cohort. A smaller fraction of 2004 senior cohort members transferred colleges compared to the 1992 cohort (17% versus 22%), but a slightly larger fraction enrolled part-time (4% versus 3%). In terms of academic achievement, college participants in 2004 had a better high school GPA (3.21 versus 3.04), but statistically similar SAT scores compared to those in 1992. They also had different demographic characteristics, in the ELS sample, students were more likely to be minority (30% versus 23%), lower SES (0.33 versus 0.40), and have higher educational aspirations than students in 1992 (97% aspired to a bachelor’s degree or higher compared to 95%).
The college characteristics of an average student also changed. ELS:2002 sample members were less likely to attend private non-profit schools (29% versus 33%) and more likely to attend private for-profit institutions (3% versus 0%) than in the NELS:88. An average student’s college in 2004 was likely to have a larger enrollment (11,900 versus 10,460), fewer part-time students (17% versus 19%), more minority students (27% versus 23%), and a smaller student-to-faculty ratio (13 versus 21) compared to the college characteristics of an average student in 1992. The percent of state postsecondary enrollment in two-year institutions and private instructions remained similar across time.

*Enrolling full-time in one institution and transferring were the most common experiences for high school graduates who enroll on-time in a four-year college.* The most common experience among on-time four-year college enrollees in 2004 was full-time enrollment in one institution (80%), followed by enrolling full-time and transferring (16%), enrolling part-time in one institution (3%), and enrolling part-time and transferring (1%). Students who enrolled in one institution full-time completed a bachelor’s degree at higher rates than other groups (65%), and had the highest levels of academic achievement (3.26 HS GPA and 1,081 SAT score), SES (0.36), and educational aspirations (97% aspired to a bachelor’s degree or higher). These students were also more likely to be female (55%) and white (71%). Part-time students had the lowest levels of bachelor’s degree completion (12%), academic achievement (2.69 HS GPA and 906 SAT score), SES (-0.01), and educational aspirations (90% aspired to a bachelor’s degree or higher), overall. They were also more likely to be men (57%) and minorities (38%).

The college characteristics of average students differed by their college experiences. Part-time students were more likely to attend public institutions (80%), colleges with larger
undergraduate enrollments (12,370), less financial expenditures per student ($12,130), and larger student-to-faculty ratios (18). Part-time students attended colleges whose student bodies were composed of more part-time students (34%) and minority students (30%).

Transfer students were most likely to come from public four-year institutions and were most likely to switch to public two-year institutions. The majority of transfer students from four-year institutions attended public colleges as their first institution (67%), followed by private non-profit colleges (31%) and private for-profit colleges (3%). For the second institution they attended, transfer students were most likely to move to public two-year institutions (47%), followed by public four-year institutions (35%), private non-profit four-year institutions (12%), and private for-profit four-year institutions (3%). The sector of institution a student transferred to was related to where the student began. Students who began in public and private for-profit colleges were most likely to transfer to public two-year institutions, whereas students who began in private non-profit colleges were most likely to transfer to public four-year institutions.

High school GPA predicted bachelor's degree completion better than SAT score. Overall, bachelor’s degree completion had a stronger relationship with high school GPA than SAT score. While, both high school GPA and SAT score were positively related to bachelor’s degree completion, high school GPA was a stronger predictor. Controlling for student background characteristics, such as minority status, gender, SES, and educational aspirations explained a significant portion of the SAT score relationship with completion. These same control variables did not explain a meaningful amount of the high school GPA relationship with completion. Furthermore, including college and state characteristics further explained the SAT score/completion relationship, but not the GPA/completion relationship.
In addition to academic achievement, SES, and the percent of state enrollment in two year colleges and in private institutions were also positively associated with higher odds of completion. Increases in student-to-faculty ratio and the percentage of part-time undergraduates, as well as attending a for-profit institution were related to lower odds of completion. There were no differences in completion between minority and white students and students attending public and private institutions after taking other variables into account.

**SAT score predicted transferring better than high school GPA.** Overall, transferring had a stronger relationship with SAT score than with high school GPA. In general, students with higher academic achievement were less likely to transfer. Controlling for student, institutional, and state characteristics did not produce a meaningful change in the size of the academic achievement/completion relationship.

Additionally, minority students had lower odds of transferring, compared to whites, after controlling for other factors. Institutional characteristics were also related to the odds a student transfers. Compared to students attending public institution, students at private non-profit institutions had higher odds of transferring. Controlling for other factors, increases in the student-to-faculty ratio and in the amount of degree-related expenditures per student were related to lower odds of transferring.

**Transferring from a four-year institution lowers the odds a student completes a bachelor’s degree.** Overall, transferring was related to lower odds of completing a bachelor’s degree. Students who transfer were less likely to complete a bachelor’s degree within six years compared to students who stay at one institution. Including transfer in the regression models
also explained a small, but significant amount of the completion/academic achievement relationship.

*Transferring is a weak mediator of the academic achievement/completion relationship.*

Transferring was a weak mediator of the relationship between bachelor’s degree completion and academic achievement. Results from the path analysis indicated that transferring significantly mediated the completion/GPA relationship. However, it mediated only 5.7% of the total effect of GPA, making it a weak mediator. Transferring also significantly mediated the completion/SAT score relationship. Transferring mediated 15.4% of the total effect of SAT score. In summary, the indirect effects of academic achievement through the transfer pathways were relatively weak compared to the total effects and the direct effects of academic achievement on completion.

**Limitations of the Study**

While one of the strengths of this dissertation was its use of two nationally representative data sets, there were some challenges with using these data sets. The number of consistent and comparable variables across each study is relatively small. Additionally, missing data, small inconsistencies in the definition of the high school senior cohort, and the exclusion of students that delay enrollment in college diminish the generalizability of the study.

One of the limitations of the ELS:2002 is that there is not much information on the academic and social experiences of students once they are in college, and very little of this information is consistent or comparable with previous nationally representative studies. Having a more detailed picture of student’s experiences on campus and at multiple time points could shed light on other mechanisms related to college completion.
Contributions of the Study

This study contributed to the literature on college completion in several ways. First, it examined college completion in the context of a high-school to college pipeline and it utilized using a new nationally representative data set to replicate prior analyses. Furthermore, it examined transfer students at four-year institutions and where they go. Finally, this study explored the mechanism by which academic achievement in high school relates to bachelor’s degree completion. The findings contribute to gaps in the literature on college completion and may also be useful for policymakers and practitioners.

First, this study looks at how the education pipeline for high school seniors has changed between 1992 and 2012. As such it provides a useful comparison for other researchers looking at the education pipeline today and its history. There were some promising changes from the 1992 to the 2004 cohorts, such as a larger percentage of high school seniors are graduating and enrolling in any college at some point than ever before. Interestingly, a larger percentage also delayed their college enrollment by 7 months or more—this change brings up the question, why? Why are students putting off college and do students who delay enrollment have a lower completion rate? There are some negative changes as well. Even though a larger percentage of high school graduates in 2004 enrolled a four-year college on-time, a smaller percentage of those students actually graduated compared to previous years. While a large emphasis has been placed on academic preparation’s role in college completion there are undoubtedly other factors that matter once students are enrolled in a college. If students have higher levels of academic achievement than previous cohorts, as found in the descriptive analysis, then why are fewer graduating within six years?
Another contribution of this study was its focus on transfer students in four-year institutions. Most research on transferring examines switching from a two-year to a four-year institution. The descriptive analyses from this study illustrated that most four-year transfer students attend public and private non-profit institutions. When students transferred from four-year institutions their most likely destination was a public two-year college, a finding that is consistent with the negative relationship between transferring and bachelor’s degree completion. The descriptive results also suggested that students who transferred from private non-profit four-year institutions were more likely to transfer to public four-year institutions; however, students who transferred from public four-year and private for-profit four-year institutions were more likely to transfer to public two-year colleges.

This dissertation also examined transfer as a mechanism by which academic achievement is related to bachelor’s degree completion. The path analysis showed that students with lower academic achievement were more likely to transfer, and that those who transfer from a four-year institution were less likely to earn a bachelor’s degree in six years. However, this study could not parse out why students were transferring or the characteristics of the receiving institution. An in-depth analysis of why students choose to transfer from four-year institutions and the differences between their sending and receiving institution would shine more light into how transfer works as a mechanism of college completion. More research as to why recent graduates choose to transfer from a four-year institutions and what their experiences are after transferring is needed. Additionally, these finding suggest that transfer may operate differently depending on where the student is transferring from and where students are transferring to.
This study also serves as a replication and update of prior research findings on academic achievement, student, institutional, and state characteristics. For instance, the findings from this study support prior research (Rothstein, 2004; Bowe & Bok, 1998; Bowen et al., 2009) findings that the relationship student background characteristics partially explain the completion/SAT relationship. Additionally, adding in the institutional characteristics of the first institution attended also explained part of the completion/SAT relationship. This suggests SAT on its own is explaining some of the variation in completion that is due to the type of institution attended, its financial resources, and the campus social environment. Furthermore, the finding that state characteristics, such as the percent of postsecondary enrollment in two-year and in private institutions, builds upon Titus (2009) findings that these state characteristics are related to bachelor’s degree production.

**Policy Implications**

This study has several policy implications. First, framing the study with a pipeline perspective is relevant given the current policy context focuses on making sure students are prepared for college and careers. Taking an education pipeline perspective to understand college experiences and completion as key transition points that are related to, and not separate from high school, is necessary in the current policy environment. The pipeline view has potential to break down the historical divide between K-12 and higher education since both sectors must work together to make progress on the current policy agenda.

The second policy implication is that both high school GPA and SAT score are strong predictors of college completion. High school GPA maintains the strongest relationship with college completion after taking into account standardized test scores, student background,
institutional, and state factors. As more institutions move towards test optional admissions policies, this study and others have shown that high school GPA can be used as a reliable predictor of the chances students will complete. This knowledge is particularly useful in the first semester a student enrolls, before college grades have been recorded. Furthermore, when institutions do admit students with lower high school GPAs, policies could be enacted to engage those students with academic and social supports for the transition to college. Although SAT score is closely related to student background and institutional characteristics, the evidence from this study suggests that SAT scores remained predictive of student outcomes after accounting for high school GPA, as well as student, institutional, and state factors. These findings suggest that GPA and SAT scores measure qualities that are distinct from each other, as well as from other factors.

Another implication is that not all transfer students are alike. Previous research has shown that students who transfer from two-year to four-year institutions are more likely to graduate than students with similar characteristics that began at four-year institutions. This study presented a unique look at students who began in four-year institutions and found that about 17% of them transfer institutions at least once. This study found that, controlling for other factors, transferring from a four-year institution reduced students’ odds of completion. Colleges could use this information to identify the two groups of transfer students and engage them in different ways.

Lastly, there are many intervening policies that could effects students’ probability of completing. Policies such as financial aid, tuition, articulation agreements, and high school graduation requirements, are set at the state level. Unfortunately this information could not be
incorporated in this study because the ELS: 2002 does not have an appropriate sampling design to support state by state analysis. How policy differences across states or changes of policies within a state affect completion is a promising direction for new research and to unpack some of the findings in this study. For instance, the finding that an increase in the percentage of state postsecondary enrollment in two-year institutions improves the odds of bachelor’s completion may be related to dual enrollment programs in states with large two-year institution enrollment. Or perhaps this finding is indicative of overall state investment in higher education. Although the relationship is small compared to academic achievement, its existence merits further attention.

Conclusion

This study provides a historical look at the educational pipeline on the national level, and provides a useful comparison point for states. The results indicate that high school GPA and SAT score are both related to college completion, but high school GPA has the strongest relationship. Not only does academic achievement matter, but so do experiences along the education pipeline. This study also shows that transferring from a four-year institution lowered the odds a student completed a degree. One of the current goals of policymakers and practitioners is to increase the educational attainment at the national, state, and local levels. This study provides an illustration of how students’ progress through the pipeline and examines the factors related to their educational attainment, or lack thereof. It demonstrates that studying student transition between high school and college completion provides useful information to policymakers and practitioners about where the holes in the education pipeline and what might be done to repair them.
Table A.1

*ELS:2002 4-Year Analytic Sample Members - Bachelor's Degree Completers by Time to Degree*

<table>
<thead>
<tr>
<th></th>
<th>Completed a bachelor's in 6 years</th>
<th>Did not complete a bachelor's in 6 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>%</strong></td>
<td>90.4%</td>
<td>9.6%</td>
<td>100%</td>
</tr>
<tr>
<td>Weighted N</td>
<td>691,990</td>
<td>73,610</td>
<td>765,600</td>
</tr>
<tr>
<td>N</td>
<td>3,300</td>
<td>320</td>
<td>3,620</td>
</tr>
</tbody>
</table>

Notes: Analytic sample consists of on-time 4-year college enrollees with complete outcome data.
Table A.2

*NELS:88 4-Year Analytic Sample Members - Bachelor's Degree*

_Completers by Time to Degree_

<table>
<thead>
<tr>
<th></th>
<th>Completed a bachelor's in 6 years</th>
<th>Did not complete a bachelor's in 6 years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>93.5%</td>
<td>6.5%</td>
<td>100</td>
</tr>
<tr>
<td>Weighted N</td>
<td>651,670</td>
<td>45,090</td>
<td>1,013,620</td>
</tr>
<tr>
<td>N</td>
<td>940</td>
<td>220</td>
<td>430</td>
</tr>
</tbody>
</table>

Notes: Analytic sample consists of on-time 4-year college enrollees with complete outcome data.

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>4-Year On-Time Enrollment</th>
<th>4-Year Delayed Enrollment</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>% Missing</td>
</tr>
<tr>
<td><strong>Primary Outcome - Degree Attainment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earned a bachelor’s within 6 years of HS graduation</td>
<td>0.59</td>
<td>0.49</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Intermediate Outcomes - College Experiences</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transferred</td>
<td>0.17</td>
<td>0.38</td>
<td>0.0%</td>
</tr>
<tr>
<td>Part-time enrollment</td>
<td>0.04</td>
<td>0.20</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Student Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Achievement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS GPA (0-4.0)</td>
<td>3.21</td>
<td>0.55</td>
<td>6.4%</td>
</tr>
<tr>
<td>SAT test score (400-1600)</td>
<td>1,068.54</td>
<td>182.79</td>
<td>8.9%</td>
</tr>
<tr>
<td><strong>Background Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minority</td>
<td>0.30</td>
<td>0.46</td>
<td>0.0%</td>
</tr>
<tr>
<td>Male</td>
<td>0.45</td>
<td>0.50</td>
<td>0.0%</td>
</tr>
<tr>
<td>SES&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.33</td>
<td>0.67</td>
<td>0.0%</td>
</tr>
<tr>
<td>Educational Aspirations (1-3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than a bachelors (Ref)</td>
<td>0.04</td>
<td>0.19</td>
<td>-</td>
</tr>
<tr>
<td>Bachelors degree</td>
<td>0.39</td>
<td>0.49</td>
<td>-</td>
</tr>
<tr>
<td>More than a bachelors</td>
<td>0.57</td>
<td>0.49</td>
<td>-</td>
</tr>
<tr>
<td><strong>Institutional Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control (1-3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public (Ref)</td>
<td>0.68</td>
<td>0.47</td>
<td>-</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0.29</td>
<td>0.46</td>
<td>-</td>
</tr>
<tr>
<td>Private for-profit</td>
<td>0.03</td>
<td>0.16</td>
<td>-</td>
</tr>
<tr>
<td>Total enrollment</td>
<td>11,946.00</td>
<td>9,989.00</td>
<td>0.8%</td>
</tr>
<tr>
<td>Degree related expenditures (in millions $)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>276.95</td>
<td>325.08</td>
<td>2.4%</td>
</tr>
<tr>
<td>Degree related expenditures per student (in thousands $)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>23.61</td>
<td>25.43</td>
<td>2.4%</td>
</tr>
<tr>
<td>Percentage of undergraduates that are part-time</td>
<td>0.17</td>
<td>0.14</td>
<td>2.0%</td>
</tr>
<tr>
<td>Percentage of undergraduates that are minority</td>
<td>0.27</td>
<td>0.22</td>
<td>0.8%</td>
</tr>
<tr>
<td>Student-to-faculty ratio</td>
<td>13.63</td>
<td>8.80</td>
<td>46.7%</td>
</tr>
<tr>
<td><strong>State Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of state PSE&lt;sup&gt;f&lt;/sup&gt; enrollment in 2-year institutions</td>
<td>0.41</td>
<td>0.12</td>
<td>0.1%</td>
</tr>
<tr>
<td>Percent of state PSEF enrollment in private institutions</td>
<td>0.18</td>
<td>0.10</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Sample N</strong></td>
<td>5,350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>*</sup>*p<.05. **p<.01. ***p<.001. Notes: Analytic sample consists of on-time 4-year college enrollees with complete outcome data. Sample N is unweighted, Mean and SD are weighted. (a) Delayed enrollment is defined as enrolling in college seven months or more after high school graduation. (b) Comparisons are made before imputation. (c) Enrolled part-time at the first institution the student attended. (d) SES is standardized on the full sample of high school seniors. (e) 2014 dollars. (f) Undergraduate postsecondary enrollment. Sources: National Center for Education Statistics, Education Longitudinal Study of 2002.
## Table A.4

### Comparison of Observations With and Without Student-to-Faculty Ratio in the ELS:2002 4-year Analytic Sample

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Has Student/Faculty Ratio</th>
<th>Missing Student/Faculty Ratio</th>
<th>Mean Difference</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Outcome - Degree Attainment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earned a bachelor’s within 6 years of HS graduation</td>
<td>0.59 (0.49) 0%</td>
<td>0.60 (0.49) 0%</td>
<td>-0.01</td>
<td>-0.02 - 0.00</td>
</tr>
<tr>
<td><strong>Intermediate Outcomes - College Experiences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transferred</td>
<td>0.16 (0.37) 0%</td>
<td>0.18 (0.39) 0%</td>
<td>-0.02</td>
<td>-0.03 - 0.01</td>
</tr>
<tr>
<td>Part-time enrollment</td>
<td>0.04 (0.19) 0%</td>
<td>0.04 (0.20) 0%</td>
<td>0.00</td>
<td>-0.01 - 0.00</td>
</tr>
<tr>
<td><strong>Academic Achievement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS GPA (0-4.0)</td>
<td>3.21 (0.54) 6%</td>
<td>3.21 (0.56) 6%</td>
<td>0.00</td>
<td>-0.02 - 0.01</td>
</tr>
<tr>
<td>SAT test score (400-1600)</td>
<td>1,068.69 (175.71) 8%</td>
<td>1,068.36 (190.59) 10%</td>
<td>0.33</td>
<td>-22.56 - 23.22</td>
</tr>
<tr>
<td><strong>Background Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minority</td>
<td>0.28 (0.45) 0%</td>
<td>0.32 (0.47) 0%</td>
<td>-0.04</td>
<td>-0.06 - 0.03</td>
</tr>
<tr>
<td>Male</td>
<td>0.46 (0.50) 0%</td>
<td>0.45 (0.50) 0%</td>
<td>0.01</td>
<td>-0.01 - 0.02</td>
</tr>
<tr>
<td>SES</td>
<td>0.33 (0.66) 0%</td>
<td>0.32 (0.68) 0%</td>
<td>0.01</td>
<td>-0.01 - 0.03</td>
</tr>
<tr>
<td>Educational Aspirations (1-3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than a bachelor’s (Ref)</td>
<td>0.05 (0.21) 9%</td>
<td>0.03 (0.18) 9%</td>
<td>0.01</td>
<td>0.01 - 0.02</td>
</tr>
<tr>
<td>Bachelors degree</td>
<td>0.39 (0.49) 9%</td>
<td>0.38 (0.49) 9%</td>
<td>0.01</td>
<td>-0.01 - 0.02</td>
</tr>
<tr>
<td>More than a bachelor’s</td>
<td>0.56 (0.50) 9%</td>
<td>0.58 (0.49) 9%</td>
<td>-0.02</td>
<td>-0.03 - 0.01</td>
</tr>
<tr>
<td><strong>Control (1-3)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public (Ref)</td>
<td>0.76 (0.43) 0%</td>
<td>0.59 (0.49) 0%</td>
<td>0.17</td>
<td>0.16 - 0.18</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0.23 (0.42) 0%</td>
<td>0.37 (0.48) 0%</td>
<td>-0.15</td>
<td>-0.16 - -0.13</td>
</tr>
<tr>
<td>Private for-profit</td>
<td>0.02 (0.13) 0%</td>
<td>0.04 (0.19) 0%</td>
<td>-0.02</td>
<td>-0.03 - 0.02</td>
</tr>
<tr>
<td>Total enrollment</td>
<td>13,225.00 (10,578.38) 0%</td>
<td>10,483.03 (9,051.22) 2%</td>
<td>2,741.97</td>
<td>-38,556.07 - 44,040.01</td>
</tr>
<tr>
<td>Degree related expenditures (in millions $)</td>
<td>293.04 (330.48) 2%</td>
<td>258.80 (317.91) 3%</td>
<td>34.24</td>
<td>93.70</td>
</tr>
<tr>
<td>Degree related expenditures per student (in thousands $)</td>
<td>22.56 (22.25) 2%</td>
<td>24.79 (28.54) 3%</td>
<td>-2.23</td>
<td>-3.24 - 1.23</td>
</tr>
<tr>
<td>Percentage of undergraduates that are part-time</td>
<td>0.18 (0.15) 1%</td>
<td>0.16 (0.12) 3%</td>
<td>0.02</td>
<td>0.01 - 0.02</td>
</tr>
<tr>
<td>Percentage of undergraduates that are minority</td>
<td>0.26 (0.22) 0%</td>
<td>0.28 (0.23) 2%</td>
<td>-0.02</td>
<td>-0.02 - 0.01</td>
</tr>
<tr>
<td>Student-to-faculty ratio</td>
<td>13.63 (8.80) 0%</td>
<td>13.63 (13.40) 100%</td>
<td>13.87</td>
<td>13.82</td>
</tr>
<tr>
<td><strong>State Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of state PSE enrollment in 2-year institutions</td>
<td>0.40 (0.11) 0%</td>
<td>0.42 (0.13) 0%</td>
<td>-0.03</td>
<td>-0.03 - 0.02</td>
</tr>
<tr>
<td>Percent of state PSE enrollment in private institutions</td>
<td>0.18 (0.10) 0%</td>
<td>0.18 (0.11) 0%</td>
<td>0.00</td>
<td>0.00 - 0.00</td>
</tr>
</tbody>
</table>

**Notes:** (a) Analytic sample consists of on-time 4-year college enrollees with complete outcome data, N=5,350. (b) Figures rounded to the nearest 10. (c) Enrolled part-time at the first institution the student attended. (d) SES is standardized on the full sample of high school seniors. (e) 2014 dollars. (f) Undergraduate postsecondary enrollment. Sources: National Center for Education Statistics, Education Longitudinal Study of 2002; National Education Longitudinal Study of 1988.
Table A.5
Logistic Regression Bivariate Analyses Results for Bachelor’s Degree Completion

<table>
<thead>
<tr>
<th>Model</th>
<th>Intercept Only Model</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal Effect a</td>
<td>Odds Ratio</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.09</td>
<td>1.46</td>
<td>***</td>
</tr>
<tr>
<td>Academic Achievement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS GPA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAT score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postsecondary Institutions N</td>
<td>1,250</td>
<td>1,250</td>
<td>1,250</td>
</tr>
<tr>
<td>Within-institution correlation</td>
<td>0.10</td>
<td>0.05</td>
<td>0.10</td>
</tr>
<tr>
<td>Student N</td>
<td>5,350</td>
<td>5,350</td>
<td>5,350</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-3,883</td>
<td>-3,456</td>
<td>-3,534</td>
</tr>
<tr>
<td>Psuedo R²</td>
<td>-</td>
<td>0.11</td>
<td>0.09</td>
</tr>
<tr>
<td>AICc²</td>
<td>7,767.85</td>
<td>6,915.78</td>
<td>7,071.04</td>
</tr>
<tr>
<td>Error Rate</td>
<td>0.38</td>
<td>0.31</td>
<td>0.33</td>
</tr>
<tr>
<td>% decrease in error rate c</td>
<td>-</td>
<td>0.18</td>
<td>0.13</td>
</tr>
<tr>
<td>Sensitivity d</td>
<td>1.00</td>
<td>0.83</td>
<td>0.81</td>
</tr>
<tr>
<td>Specificity e</td>
<td>0.00</td>
<td>0.45</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Notes: (a) The marginal effects represent the change in the probability of completion for a 1 unit increase in X, for individuals with an average probability of completion (0.59). (b) AICc is a model fit statistic that corrects for sample size and the number of covariates, smaller is better. (c) The error rate is the percentage of predictions that are incorrect. The percentage decrease in error rate is obtained by comparing the error rate for a particular model with the error rate for the intercept only model. (d) Sensitivity is the proportion of bachelor’s degree completers which are correctly identified. (e) Specificity is the proportion of those who did not complete a bachelor’s which are correctly identified.

Table A.6
Logistic Regression Bivariate Analyses Results for Transferring

<table>
<thead>
<tr>
<th></th>
<th>Intercept Only Model</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal Effect*</td>
<td>Odds</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.22</td>
<td>0.21 ***</td>
<td>0.19 0.22</td>
</tr>
<tr>
<td>Academic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement</td>
<td></td>
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<tr>
<td>HS GPA</td>
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<td>SAT score</td>
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<tr>
<td>Institutions N</td>
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<td>0.02</td>
<td>0.02</td>
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<td>Student N</td>
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<tr>
<td>Log Likelihood</td>
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<td>-2,597</td>
<td>-2,588</td>
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<tr>
<td>Psuedo R²</td>
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<td>AICc</td>
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<td>5,179.45</td>
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<tr>
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<td>0.16</td>
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<tr>
<td>% decrease in error rate</td>
<td>-</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
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<td>0.00</td>
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<tr>
<td>Specificity</td>
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<td>1.00</td>
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</tr>
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</table>

* p<.10.  *p<.05. **p<.01. ***p<0.001. Notes: (a) The marginal effects represent the change in the probability of transferring for a 1 unit increase in X, for individuals with an average probability of transferring (0.17). (b) AICc is a model fit statistic that corrects for sample size and the number of covariates, smaller is better. (c) The error rate is the percentage of predictions that are incorrect. The percentage decrease in error rate is obtained by comparing the error rate for a particular model with the error rate for the intercept only model. (d) Sensitivity is the proportion of bachelor’s degree completers which are correctly identified. (e) Specificity is the proportion of those who did not complete a bachelor’s which are correctly identified.

|                      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Unweighted High School GPA |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| SAT Score            | 0.56|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Minority status      | -0.24-0.31|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Male                 | -0.18-0.06-0.01|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| SES                  | 0.17| 0.40| 0.26| 0.07|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Educational aspirations | 0.23| 0.25| 0.03| 0.09| 0.18|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Less than a BA       | -0.12-0.17| 0.06| 0.00| 0.13| -0.52|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| BA                   | -0.18| -0.17| 0.01| 0.10| -0.11| -0.76| -0.16|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| More than a BA       | 0.22| 0.23| 0.02| -0.10| 0.16| 0.95| -0.22| -0.93|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Control of institution| -0.02| 0.08| 0.01| 0.00| 0.05| 0.00| 0.03| -0.03| 0.02|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Public               | -0.04| -0.13| 0.03| 0.01| -0.08| -0.04| 0.00| 0.05| -0.05| -0.96|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Private              | 0.10| 0.17| -0.04| -0.03| 0.12| 0.08| -0.03| -0.07| 0.08| 0.79| -0.94|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| For-profit           | -0.18| -0.11| 0.04| 0.05| -0.08| -0.11| 0.10| 0.05| -0.09| 0.52| -0.24| -0.11|     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Total enrollment     | 0.11| 0.13| 0.04| 0.00| 0.09| 0.07| -0.04| -0.05| 0.06| -0.51| 0.53| -0.49| -0.15|     |     |     |     |     |     |     |     |     |     |     |     |     |
| Expenditures in millions | 0.28| 0.35| 0.03| -0.01| 0.20| 0.16| -0.07| -0.13| 0.16| -0.23| 0.22| -0.18| -0.12| 0.69|     |     |     |     |     |     |     |     |     |     |     |
| Expenditures per student | 0.26| 0.37| 0.03| 0.01| 0.18| 0.14| -0.05| -0.12| 0.14| 0.22| -0.26| 0.29| -0.06| -0.02| 0.53|     |     |     |     |     |     |     |     |     |     |
| Percentage of part-time students | -0.26| -0.35| 0.09| 0.00| -0.20| -0.13| 0.12| 0.06| -0.11| -0.15| 0.20| -0.23| 0.07| 0.10| -0.21| -0.31|     |     |     |     |     |     |     |     |     |
| Percentage of minority students | -0.23| -0.23| 0.50| 0.01| -0.16| -0.02| 0.05| -0.01| 0.00| -0.04| 0.06| -0.08| 0.05| 0.10| 0.07| 0.07| 0.17|     |     |     |     |     |     |     |
| Student to Faculty ratio | -0.18| -0.28| 0.00| 0.01| -0.12| -0.11| 0.06| 0.08| -0.11| -0.15| 0.18| -0.20| 0.04| 0.02| -0.29| -0.38| -0.35| 0.00|     |     |     |     |     |     |
| Percentage of state PSE enrollment in two-year institutions | 0.01| 0.00| 0.24| 0.00| -0.01| 0.01| 0.01| -0.01| 0.01| -0.04| 0.05| -0.06| 0.03| 0.15| 0.15| 0.06| -0.06| 0.30| -0.01|     |     |     |     |
| Percentage of state PSE enrollment in private institutions | -0.06| 0.05| -0.15| 0.00| 0.03| 0.02| -0.02| -0.01| 0.01| 0.16| -0.17| 0.17| 0.01| -0.22| -0.09| 0.04| 0.10| -0.21| -0.06| -0.59|     |     |     |     |
| Part-time enrollment | -0.18| -0.16| 0.04| 0.05| -0.09| -0.10| 0.07| 0.06| -0.09| -0.01| 0.04| -0.08| 0.10| 0.02| -0.07| -0.08| 0.22| 0.03| 0.13| -0.03| -0.03|     |     |     |
| Transfer student     | -0.13| -0.14| 0.00| -0.01| 0.00| 0.06| 0.02| 0.05| -0.06| 0.01| -0.01| 0.01| 0.00| -0.05| -0.10| -0.09| 0.06| 0.01| 0.01| -0.01| 0.00| 0.01|     |
| Earned a bachelor’s in 6 years | 0.38| 0.54| 0.14| -0.04| 0.21| 0.12| -0.10| -0.07| 0.11| 0.02| -0.06| 0.10| -0.10| 0.04| 0.17| 0.16| -0.25| -0.13| -0.18| 0.02| 0.06| -0.18| -0.18|     |

Note: Correlations greater than ±0.03 are significant at p<.05 (2-tailed) and correlations greater than ±0.04 are significant at p<.01 (2-tailed). Pearson Correlation Coefficients. N = 5,350. Source: National Center for Education Statistics, Education Longitudinal Study of 2002.
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