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An Investigation of How Institutional and State Characteristics Influence Community College Award Rates

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An Investigation of How Institutional and State Characteristics Influence Community College Award Rates

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Jacob Andrew Kamer

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DEDICATION

To my mother, Janet Paxton. Thank you for always believing in me—even when I didn't believe in myself—and for teaching me the importance of education.

To my nieces, Jacey and Darcy Bingham and Harper Kamer. No matter the paths you decide to take, I hope you never stop learning.

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ABSTRACT

Community colleges are an essential element of the American postsecondary landscape and workforce preparation. In 2017, over six-million students, which represented roughly one-third of the total undergraduate enrollment in the United States, were enrolled in community colleges. In the past ten years, the importance of community colleges in the economic need for greater postsecondary credential attainment has been underscored by state policies and national initiatives. The wide variation in both the nature of community colleges and the students they serve makes examining the outcomes of these institutions difficult and oftentimes imprecise.

Assessing the performance of community colleges and determining what factors positively or negatively relate to their outcomes remains incompletely investigated. Statistical models of community college outcomes have failed to account for the distinctive characteristics of community colleges and have studied these institutions in isolation from their environments. Many of the limitations within literature may be attributed to insufficient data availability at the times of those studies. Adequate data, however, have recently become available that allow for the exploration of community college outcomes in a deeper and more meaningful way.

This dissertation study investigated how institutional and state characteristics of community colleges determine award rates. This was accomplished by accounting for salient variables, by leveraging three national datasets, and by using a more appropriate analytical method for the study of community colleges at the national level.

The results of ordinary least squares and multilevel regressions revealed variation between the institutional characteristics that significantly predict community college award rates once differences between states are taken into consideration. Moreover, variation was also observed in the institutional characteristics that significantly predict the award rates for all

entering, first-time, and not-first-time students. In general, however, degree of urbanization, institutional type, and the proportions of part-time students, non-degree-seeking students, racial minority students, and female students emerged as consistent significant predictors across all statistical models.

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CHAPTER I

INTRODUCTION

Heralded as an invention of American vision and ingenuity and stylized as *democracy's colleges*, community colleges are a mainstay of postsecondary education in the United States (Birnbaum, 1988; Boggs, 2012; Thelin, 2011). These two-year institutions are often recognized for their open-access enrollment policies, geographic spread, low tuition rates, and combination of transfer-oriented and vocational programmatic offerings. In the fall semester of 2017, the enrollment at these institutions represented 35% of the total national undergraduate enrollment (National Center for Education Statistics, 2020a). Despite enrolling a substantial proportion of the nation's undergraduates, community colleges graduate only 27% of their first-time, degree-seeking enrollees within six years (when considering students who started at a community college but completed an award at a different institution, this total increases to roughly 39%; Juszkiewicz, 2017; Shapiro, Dundar, Wakhungu, Yuan, Nathan, & Hwang, 2016).

The factors that promote credential attainment at community colleges are only vaguely understood. Past empirical studies have assessed how select student and institutional characteristics relate with outcomes, but they have done so under the assumption that community colleges operate within static, similar environments. Community colleges in different states, for example, are subject to different policy regulations, student groups, economic environments, and industry or market demands. Stated more colloquially, prior research has ignored the community aspect of community colleges. Through the omission of germane information or the reliance on outdated empirical models, past studies have created a notable gap in the literature at a time when community college performance and degree production are at the forefront of political actions and initiatives.

Current Context

The last decade has been a formative time for community colleges. While two-year college enrollment has been declining since 2010, when these institutions enrolled roughly 43% of all undergraduates, the National Center for Education Statistics (2020a) projected their enrollments to remain stable for the next eight years. During the Great Recession following the 2008 financial crisis, community colleges became the focus of policies grounded in economic needs. This period marked a renewed emphasis on the economic value of a postsecondary credential, though from the perspective of meeting labor market demands rather than improving an individual's social and financial welfare (e.g., Carnevale & Smith, 2012; Carnevale, Smith, & Strohl, 2013).

Two notable studies from Georgetown University's Center on Education and the Workforce illustrated the gap between postsecondary credential production and the workforce's predicted needs. Carnevale and Smith (2012) projected that by 2020 roughly two-thirds of all jobs across the nation would require some measure of postsecondary training, and that, cumulatively, southern states were roughly a decade behind the national average. Through raising postsecondary attainment rates, states may catch up to national averages by increasing their human capital and attracting additional industries. Carnevale, Smith, and Strohl (2013) also projected that by 2020, 55 million jobs would open within the national economy, with roughly 35 percent of them requiring education beyond high school.

Because two-year degrees and less-than-two-year credentials allow students to enter the workforce in a shorter time frame (and therefore have a more immediate impact on the economy), community colleges became the focus of political initiatives and efforts to improve their outcomes. To illustrate this, the Lumina Foundation (2019) has set a national goal of

increasing the proportion of American adults with a postsecondary credential to 60 percent by 2025. The Lumina Foundation (2019) reported a national postsecondary attainment rate of 48.4% (as of 2018) and that 43 states had set their own equivalent goals to improve these rates. Specifically addressed to community colleges, the American Association of Community Colleges (2012) recommended a 50-percent increase in credential attainment by 2020.

Even with the increased focus on and importance placed upon community college performance, the factors that contribute to their completion rates are only vaguely understood. Empirical studies on community college completion rates often omit or neglect to include valuable contextual elements on these institutions. Furthermore, previous studies have treated statistical models of community college performance not dissimilarly from how completion rates at four-year institutions are studied.

Community colleges have a history and purpose (or, in some cases, multiple purposes) that make them distinct from the more traditional and older forms of higher education in the United States. To provide a more comprehensive overview of community colleges and to underscore that which makes them distinct, the following section presents an overview of the historical development of these institutions.

Historical Development of Community Colleges

While American higher education can trace its roots back to the founding of Harvard University in 1636, the institutions now known as community colleges first emerged in the early Twentieth Century. Often considered the brainchild of University of Chicago president, William Harper Rainey, junior colleges were the predecessor to the modern-day community college. Junior colleges offered the first two years of a liberal arts education with the intention that students would then transfer to four-year institutions. Joliet Junior College in Illinois, which

opened in 1901, is credited as being the first of these institutions (Thelin, 2011). Some debate exists as to whether these institutions were meant to provide wider access to higher education or to act as a filter for the four-year institutions. Regardless of the intent of the masterminds, these institutions were established by and supported through local efforts (owing to the eventual use of the term *community colleges*). They were locally funded and had the abstract intent of developing local civic leadership (Pedersen, 1997).

Since their formation, community colleges have experienced exponential growth in their enrollments and geographic spread, in addition to changes in their academic offerings. From the efforts of universities to standardize (or accredit) the academic policies and parameters, junior colleges became grouped into hierarchical systems in the 1940s. At that time, 456 junior colleges serving almost 150,000 students were in operation (Thelin, 2011). Following the end of World War II and the passage of the Servicemen's Readjustment Act of 1944 (widely known as the GI Bill), junior colleges experienced a shift toward vocational education and an enrollment surge. By serving the academic needs and intentions of soldiers returning from war and of new cohorts of recent high school graduates, community colleges also reinforced their role in preparing students to transfer to four-year colleges. Though historians disagree on exact counts, by 1950, enrollment at community colleges rose to between 168-218,000 (Brubacher & Rudy, 1997; Thelin, 2011). By 1960, enrollment grew to between 394-454,000, and by 1970 enrollment peaked to over two million students (Brubacher & Rudy, 1997; Thelin, 2011). Between 1960-70, an estimate of one community college campus per week opened across the United States. Certainly contributing to the enrollment surge, the open-admission policies (with which community colleges are often associated) began to be adopted *en masse* by these institutions during the 1960s.

Into the 1970s, community colleges further expanded their missions to serve non-degree-seeking students and to offer remedial education programs for students whose academic capabilities were deemed less than college level. Subsequently, the academic profile of community college students began to wane and become more distinct from the four-year institutions. Around this same time, statewide funding formulas emerged to provide an objective framework by which to administer state appropriations. Institutional missions and efforts, subsequently, were swayed by the parameters of state funding formulas (Thelin, 2011). While these formulas were widely based on enrollment in the beginning, states have more recently and steadily progressed toward considering institutional outcomes in the distribution of state funding. Tennessee was the forerunner of this effort by adopting the outcomes-based funding formula in 2010. In that same year, community colleges hit a peak in enrollment following the financial crisis of 2008 (NCES, 2019). For institutions that have a varied, potentially unbalanced, and unclear institution mission, vision, and purpose, determining appropriate measures of success and identifying what contributes to that success are ambiguous tasks (e.g., Miller, 2007; Willems, Jegers, & Faulk, 2016).

The community colleges in operation today are products of their history. Modern-day community colleges embrace competing missions and serve heterogeneous student groups, each with potentially different needs and risk factors affecting their success. Due to this variation, common methods of assessing outcomes at postsecondary institutions (e.g., graduation rates, which are often based on a specific subset of students) do not make for an entirely accurate or meaningful representations for many community colleges. Additionally, graduation rates for community colleges are often restricted to the 150% (three-year) rate, which is based on the cohort of first-time, full-time freshmen entering during the fall term of each academic cycle.

Because the majority of community college students attend on a part-time basis (National Center for Education Statistics, 2020a), three years may be considered too short of a timeframe to measure outcomes.

Past studies have also failed to hold into account the clustered nature of community colleges. In other words, prior research overlooks the community aspect of community colleges. As compared to four-year institutions, community colleges are more closely coupled with their surrounding environments and industries. These institutions derive their enrollment from within a specific geographic range. Fluctuations within these clustered environments (e.g., economic factors, such as unemployment rates) are likely to affect community college enrollments more so than at four-year institutions.

Statement of the Problem

Community colleges are responsible for the education of millions of undergraduates each year, yet the relationship between vital characteristics of these institutions and their outcomes remains underexplored. Previous models of community college performance have become outdated and have omitted vital pieces of information that distinguish these colleges from other types of institutions. In addition, prior empirical research has often lacked meaningful outcome data. While credential attainment is certainly a clear, logical, and valuable outcome for these institutions, graduation rates are based on the first-time, full-time freshmen cohort, which are not reflective of the average community college student. These institutions also carry the burden of the completion agendas and the predicted economic need for an educated populace. In addition to these methodological gaps, comprehensive data that can illuminate a more meaningful study of community college completion rates have only recently become available.

Research Purpose

The purpose of this dissertation study is to investigate how institutional and state characteristics of community colleges predict award rates. This purpose will be accomplished by accounting for data that are qualitatively linked to community colleges but are often neglected or omitted in statistical models and by using a more appropriate analytical method.

Research Questions

This study will be guided by and will aim to answer three research questions.

1) Which institutional characteristics significantly influence community college award rates?
2) How do community college award rates vary across states?
3) Which institutional characteristics significantly influence community college award rates after accounting for state-level characteristics?

Summary of Methods and Procedures

To address the first question, ordinary least squares regressions will be employed using a block-entry method. This approach will provide the researcher with a more comprehensive insight into how parameter estimates and the proportion of explainable variance change with the inclusion of additional explanatory variables. Addressing the second and third research questions will rely upon multilevel modeling techniques. While descriptive statistics may provide a superficial look into how award rates at community colleges vary by state, as displayed in Table 6.1 located in Appendix A, more sophisticated techniques can provide insight into the significance and magnitude of this variation. Through multilevel modeling, or the creation of a linear mixed model, the intraclass correlation coefficient (ICC) may be calculated, which will help to quantify how award rates vary between states. Furthermore, the effects of state

characteristics on institutional outcomes may be studied using multilevel modeling. In Chapter III of this dissertation, a more thorough description of the procedure, its benefits, and its methodological assumptions will be discussed. All data cleaning, statistical assumption testing, and inferential analyses will be conducted in SPSS (version 24).

Significance

The results of this study will have scholarly and political implications. From the perspective of scholarship, this study fills a critical gap in the literature on community college outcomes in three distinct ways. First, prior studies, which will be discussed in the next chapter, present an incomplete picture of how institutional characteristics affect community college outcomes. Second, prior research on community college outcomes carried out at the national level encountered data limitations that can now be accounted for. Third, the proposed research will act as an extension and clarification of prior research, which will further add to the cumulative understanding of what influences community college outcomes.

From a political perspective, this study will come in the midst of state and national initiatives aimed at improving community college outcomes and increasing the proportion of the workforce educated at the postsecondary level. The results of this study will contribute to ongoing conversations surrounding the national completion agenda.

Delimitations

Institutions to be included in this study will be delimited to those classified as public, two-year institutions in the Integrated Postsecondary Education Data System (IPEDS). Due to accounting and financial differences between publicly funded institutions and private schools (insert citation), not-for-profit and for-profit were excluded from the selection in order to make

comparisons between institutions more meaningful and practical. As such, a natural extension of this study would be to focus on the private, two-year institutions.

This study will be further delimited by geographic specification. Data in IPEDS reflect all postsecondary institutions that participate in federal student aid programs across all 50 states and American territories. The current study will delimit the list of institutions to exclude those operating in outlying areas (e.g., Guam, Puerto Rico).

Limitations

The proposed study is estimated to have two general types of limitations at the outset: situational limitations and data limitations.

Situational Limitations

Though using secondary data, this study will be conducted during an unpredictable, precarious time for higher education institutions in the United States. During the early months of 2020, the coronavirus disease of 2019 (COVID-19) pandemic prompted college leaders to migrate their operations to almost exclusively online or distance-learning formats. While the threat of COVID-19 will certainly ebb, its mid- and long-term effect on postsecondary education institutions is yet to be seen. If substantial changes to general community college practices and policies emerge from the response to this pandemic, the results of this study may not be wholly representative, meaningful, or applicable.

Data Limitations

A natural limitation of this study comes from its use of secondary (i.e., existing) data, or data that have not been collected directly by the researcher. The sources and nature of the data to be used in this study are discussed in greater detail in Chapter III. Even so, these data were not collected specifically for purposes of the proposed research herein. As such, there is a distance

between the researcher and the data collection procedures. This limitation may manifest in the use of proxy variables, variables which are substituted or used to represent constructs of theoretical or conceptual importance, in the design of statistical models.

Additional limitations relative to the current study pertain to data availability. This study will make use of variables from the 2018, 2014, 2013, 2012, and 2011 data files in IPEDS. Variables contained in more recent data files may not be available for earlier years due to changes in the length and scope of the annual IPEDS surveys. Unlike the other data files to be leveraged in this study, certain aspects of the 2018 file are classified as preliminary, which indicates that those data may yet change before the file is considered final.

The unit of analysis for all data sourced from IPEDS is measured at the institution level. Differences between individual students and how they explain variation in outcomes at community colleges are beyond the scope of the current study. Furthermore, because data for this study will be aggregated using the four-year averages. The year-specific effects of any variable on degree outcomes will remain unclear at the conclusion.

For the group-level variables, this study will rely on state characteristics. One could reasonably argue that if community colleges are closely coupled with their surroundings, then the county- or community-level data would be a more appropriate choice to represent the grouping structure. Although county-level data are available through the United States Census Bureau, using those data as the group-level characteristics presents a methodological problem. Because a community or county may only have a single community college within it, the study data would have zero within-group variance.

Furthermore, only measures of unemployment rates and median household income will be included to represent state-level characteristics. Germane to postsecondary institutions, some

states (e.g., Tennessee) fund public postsecondary education by means of an outcomes-based funding formula. As a part of a study on the effects of performance-based funding in Tennessee, Li and Ortagus (2019) noted the lack of agreement as to the total number of states operating under an outcomes-based funding model, with estimates ranging from 29 to 46 states. Ortagus, Kelchen, Rosinger, and Voorhees (2020) reported that 41 states have or leverage performance-based funding formulas. In addition to the ambiguity surrounding the total count, states may also vary in the degree to which and the formula is based on outcomes. To illustrate, Li and Ortagus (2019) noted that in 2010 Tennessee increased the proportion of outcomes-based funding from roughly 5 percent to 85 percent. States that have outcomes-based funding may have migrated to that method at different times (e.g., Tennessee migrated in 2010 as a result of the Complete College Tennessee Act). Because the proposed study will consider multiyear averages of historical data and because there is little agreement in which states operate under performance-based funding or when they began using those methods, performance-based funding is not included as a state-level covariate.

Organization of the Study

Five distinct chapters constitute this study. The first three chapters represent the proposal: the need for the study and how it will be conducted. The final two chapters pertain to the results of and the conclusions drawn from the study. The motive of the first (current) chapter is to illuminate the problem of interest and the purpose of the study while providing the reader with adequate knowledge of the context. In addition, this chapter provided an outline of the study's research questions, significance, delimitations, and limitations. The following chapter will comprise a discussion of the study's theoretical and conceptual underpinnings and a review of the scholarly literature concerning student outcomes at community colleges. The third chapter

details the study's methods and the data to be leveraged. To this end, the third chapter will provide a discussion on the research design, data collection and cleaning, and analytical procedures (e.g., testing statistical assumptions and building the statistical models). The fourth chapter will present the results of this study, and the fifth chapter will serve as the study's conclusion. The fifth chapter will carry a dual impetus: (1) to discuss the results of the study in relation to community colleges and the completion agenda and (2) to summarize pertinent recommendations for policy, practice, and future research.

CHAPTER II

LITERATURE REVIEW

The purpose of this study is to investigate how institutional and state characteristics predict award rates at community colleges. This chapter has a twofold intention: to provide an overview of the relevant scholarly literature and to discuss the theoretical and conceptual frameworks to be used in the proposed study. The aim of this chapter is to ascertain what is known about how institutional characteristics relate to community college outcomes while illuminating the areas in which additional research is warranted. Past studies in this area have grouped characteristics of community colleges into three general domains: general characteristics, student enrollment characteristics, and institutional resources and expenditures. This chapter will begin by presenting the findings from the literature relating to these three domains.

General Characteristics

In the current literature on community college outcomes, general characteristics refer to an institution's most basic aspects: its location, its size, and its type or classification. The following paragraphs discuss what past studies have observed in relation to these characteristics.

Urbanization

Community colleges source the principal of their enrollment and instructional staff locally. As such, models of community college outcomes must (and often include) the degree of urbanization (Bailey, 2012). Using two national datasets and a logistic regression to predict community college degree completion (delimited to associate degrees), Goble, Rosenbaum, and Stephan (2008) observed that middle-achieving community colleges students were significantly more likely to complete a degree at suburban colleges than their peers at urban colleges.

Unfortunately, the researchers omitted the regression coefficients from the tabulated results and presented only the statistically significant variables and the direction of their influence (positive or negative). In a more recent empirical study, Horn, Horner, and Lee (2017) confirmed that urban community colleges were linked with lower success rates and rural institutions were associated with greater likelihoods of completion.

Size

In past studies of community college outcomes, institutional size has been consistently observed as a significant predictor of outcomes. In a national study of community colleges, Calcagno, Bailey, Jenkins, Kienzl, & Leinbach (2008) assessed how institutional characteristics influenced the likelihood of student degree completion. While they concluded that individual student effects had greater influence over individual student outcomes, they observed that institutional size was negatively related to the likelihood of degree completion. Put more specifically, the researchers found that students enrolled in larger community colleges were between 13 percent and 19 percent less likely to graduate when compared to institutions with fewer than 1,000 full-time equivalent (FTE) students.

Despite being a well-cited and early study of community college characteristics' effects on academic outcomes, Calcagno et al.'s (2008) study, there are a few caveats and critiques worthy of mention. Their study used a combination of the National Education Longitudinal Study of 1988 (NELS:88) and IPEDS data. The researchers report merging the NELS:88 with IPEDS using transcript data, which resulted in a dataset representative of only 536 community colleges. How these community colleges were distributed across or grouped within states remains unclear, and the researchers do not appear to have considered how such a grouping structure could have influenced or biased the results of their study.

Institutional Type

Owing to their history (as discussed in the previous chapter), community colleges offer academic transfer programs and vocational programs. The degree to which any particular institution offers one over the other, however, has not been uniformly incorporated into past studies. For example, Calcagno et al. (2008) modeled this characteristic by means of a binary variable indicating whether the college awarded more associate degrees than certificates. In a fashion, the researchers used this binary indicator as a proxy for institutional mission. Even so, this method failed to account for the proportion of terminal associate degrees awarded in career and technical education fields (i.e., Associate of Applied Sciences) and, perhaps, represented the community college's instructional focus less than fairly.

In their study of how graduation rates vary across community colleges of different curricular emphases, Ishitani and Kamer (2020) leveraged the Carnegie Classifications reported out of IPEDS, which distinguished community colleges as being high transfer, high career and technical, or mixed transfer/career and technical. Through a sequence of multiple regression analyses, the researchers observed that predictor variables ranged in magnitude and significance based on the institutional type. In addition, though using the same dependent variable (150% graduation rates), Ishitani and Kamer (2020) noted that the proportion of variance explainable by the empirical model ranged from 42 percent to 49 percent. As previously established, however, a graduation rates are not an entirely fair means of assessing community college performance, which constitutes a noteworthy limitation to Ishitani and Kamer's (2020) research.

Student Enrollment Characteristics

Past studies of community college outcomes included the proportions in which student groups are represented in the total enrollment. The student enrollment characteristics included in

these studies have included gender, race, age, enrollment intensity, and Pell Grant recipients. The literature related to each of these student enrollment characteristics will be discussed below.

Gender

Gender often appears as a covariate in statistical models of institutional outcomes, but the significance and magnitude of this characteristic has varied across studies. In a generalized linear mixed model study of community college outcomes, Yu (2017) combined IPEDS data with the Beginning Postsecondary Students Longitudinal Study (BPS: 04/09) and found that gender was not a significant predictor of the likelihood of degree completion within a three-year period. Female students, however, had a higher likelihood of degree completion within a six-year period. Yu's (2017) research was, however, limited to only 50 community colleges in 2003-2004. Despite being older data used for the study, the resulting dataset may not be truly representative of all community colleges. Furthermore, the researcher gave no mention of how the community colleges included in the study were distributed across or within states, nor was a measure or indicator of institutional type incorporated into the statistical model.

Patel and Jepsen's (2018) event history model of student outcomes at community colleges in Kentucky revealed that women were 34 percent more likely than men to graduate. Through their use of an administrative dataset, which represented 16 community colleges and 67 campuses, the researchers also noticed differences between men and women regarding the effects of unemployment rates and academic outcomes. Of course, with the study limited to community colleges within Kentucky, the results and recommendations cannot be generalized to all institutions in that sector across the nation.

Race

Like with gender, prior research has historically modeled some measure of race in studies of institutional outcomes. Unlike with gender, however, studies have consistently found race to be a statistically significant covariate. Yu (2017) found that minority students had significantly lower likelihoods of degree completion within three and six years at community colleges. Similarly, Patel and Jepsen (2018) found that non-White students were more likely than their White peers to drop out without a credential. Calcagno et al. (2008) found the proportion of racial minority students (defined as Black, Hispanic, and Native American students) enrolled at a community college to be a significant predictor of degree completion. From their econometric models of IPEDS data, the researchers observed that students enrolled in community colleges with minority student enrollments of 75 percent were roughly 19 percent less likely to earn a credential.

Age

Because of their wide geographic spread and diverse programmatic offerings that may be linked with local industry needs, community colleges are popular and ideal options for adult students. Typically defined as undergraduate students over the age of 24, adult undergraduates represent approximately 27 percent of the national enrollment (Blumenstyk, 2018). This population of students is unequally weighted toward the community college sector, as demonstrated by Patel and Jepsen's (2018) event history model of community college outcomes across Kentucky. Their sample of over 65,000 students had an average age of 27.9 years. Patel and Jepsen's (2018) study is one of few pertaining to community colleges that takes into account age. From their analyses, the researchers observed that employment (a factor often linked with

adult students) increased the likelihood of dropping out for adult students and decreased the likelihood of degree completion for community college students by six percent.

Using IPEDS data, Kamer and Ishitani (2020) studied the influence of the proportion of adult students enrolled at community colleges. Based on a three-year average (2015, 2016, 2017), the researchers reported that adult students represented over 37 percent of community college enrollment. Based on their multiple linear regression results, Kamer and Ishitani (2020) found that adult student enrollment shared a significant and negative relationship with three-year institutional outcomes.

Enrollment Intensity

Roughly 60% (Bailey, 2012) of community college students enroll on a part-time basis. This approximated proportion continues to hold true. According to the National Center for Education Statistics (NCES, 2020a), only 37 percent of the nearly six million undergraduates enrolled in two-year institutions were classified as full time. By the nature of their enrollment intensity, part-time students take longer to complete an academic credential. As such, prior research on the institutional influences of community college outcomes has consistently held constant the proportion of part-time students as a covariate (e.g., Calcagno et al., 2008).

Pell Grant Recipients

Patel and Jepsen (2018) found that financial aid shares a negative relationship with the likelihood of dropping out and a positive relationship with the likelihood of degree completion. Similar to Patel and Jepsen's study, Park and Scott-Clayton (2018), too, made use of an administrative dataset in their research on community colleges, though with a specific focus on the effects of Pell Grant eligibility. Their single-state, regression discontinuity design study leveraged data from 20 community colleges echoed the positive relationship between Pell Grant

receipt and academic outcomes at community colleges. The researchers also observed, relative to community colleges that participate in federal student loan programs, an increase in enrollment intensity (i.e., full-time enrollment status) with the receipt of a modest Pell Grant amount.

Likewise, Moosai, Walker, and Floyd (2011) noted rising proportions of financial aid recipients was linked to an increase in graduation rates. For grants, the researchers found that receiving this form of financial aid corresponded to a 25 percent increase to the likelihood of degree completion. Specifically for Pell Grants, Chen and Hossler (2016) found that this form of grant was positively related to six-year graduation rates at community colleges. Based on their event history model using a longitudinal national data, the researchers observed that the probability of degree completion increased by 1% for every $1,000 in Pell Grants. Though the magnitude of this effect seems miniscule, compared with federal subsidized and unsubsidized loans, Chen and Hossler (2016) noted that only Pell Grants shared a positive relationship with six-year graduation rates. Of special note, Pell Grants serve a dual purpose in empirical studies. Along with acting as a predictor for degree completion, they may also work as a proxy for a student's economic status. Pell Grants awards are based on a combination of Expected Family Contribution (EFC), cost of attendance, and enrollment-related factors, which makes them potential indicators for financially needy students (Federal Student Aid, 2018).

Institutional Resources and Expenditures

Part-Time Faculty

Owing to their close ties to and reliance on local workforce , community colleges may depend on high proportions of part-time faculty (Birnbaum, 1988; Charlier & Williams, 2011). The degree to which this characteristic of community colleges was related to institutional outcomes came under study over a decade ago in Jacoby's (2006) widely cited multiple

regression study. Jacoby (2006) examined the graduation rates of over 900 public, two-year colleges and found that as the ratio of part-time faculty increased, so did the graduation rate decrease. Jacoby argued that the reliance on part-time faculty may be financially appealing, doing so may come at the expense of student outcomes. Despite the research being an informative and influential study, Jacoby omitted salient details about community colleges from his study. His statistical model included characteristics pertaining to size, race, outcomes, student-faculty ratios, and part-time faculty ratios, but no mention was given for the proportion of female students or for institutional type. In short, Jacoby's (2006) study investigated the effect of a commonly cited attribute of community college on institutional outcomes, but the research may have inadvertently been insensitive to other important characteristics.

Institutional Expenditures

Past studies have modeled four types of institutional expenditures as functions of institutional outcomes: those allocated to instructional services, academic services, student services, and institutional services. These characteristics are broad categorizations of how institutions spend resources and are generally considered to be core expenditures. Consistent throughout the literature consulted for the current study, institutional expenditures are entirely derived from IPEDS. Based on the glossary entries within IPEDS (2020), instructional services would include expenses pertaining to credit-bearing and non-credit-bearing academic instruction. Academic support expenditures would include curriculum development, libraries, and academic personnel. Three examples of student services expenditures would include administrative functions such as admission, registration, and student counseling. The fourth category, institutional support, would broadly encompass administrative and executive functions.

From the perspective of four-year colleges, Ryan's (2004) study is widely cited. Using an OLS regression technique and data sourced from IPEDS, Ryan (2004) determined that instructional and academic support expenditures shared a positive relationship with graduation rates, with instructional support expenditures having the greatest magnitude. In contrast, Ryan observed student support expenditures to be neither positive nor significant. Likewise, Ryan (2004) found institutional support expenditures to not be statistically significant.

Contrasting Ryan's (2004) study, Calcagno et al. (2008) included the aforementioned expenditure categories in their study on community college outcomes and found that only one type of expenditure to be statistically significant. The researchers observed that academic support expenditures shared a significant and negative relationship with the likelihood of a community college student earning a credential. From their sample data, they noted that community colleges expended $472 per full-time equivalent (FTE) student on academic support. For every $1,000 increase in this expenditure category, however, the likelihood of completing a degree diminished by 12 percent. Based on this result, the authors speculated upon numerous explanations before noting that the relationship between academic support expenditures and degree attainment is weak. Given that the Calcagno et al. (2008) study is over a decade old, further investigation using updated data may yield new, and perhaps more meaningful, insight.

Other Factors Germane to Community College Outcomes

Considering the general characteristics, student enrollment characteristics, and institutional expenditures outlined above presents a limited picture of community colleges. Some institutional elements of community colleges, though recognized as distinguishing community colleges from other types of postsecondary institutions, have gone neglected in empirical studies.

Distance Education

A characteristic widely omitted from the empirical models on community college outcomes is the proportion of students enrolled in distance education coursework. Distance education rapidly expanded at community colleges in the mid-to-late 1990s and into the 2010s both in the number of institutions offering distance education coursework and in the number of students participating in distance education (Cohen, Brawer, & Kiser, 2014). According to NCES (2019a), nearly 2 million students at two-year institutions were enrolled in distance (e.g., online, correspondence, hybrid) education coursework in Fall 2017, which represented roughly 35 percent of the total undergraduate distance education enrollment across the nation.

While taking at least one online course is becoming increasingly common, online education has lower rates of completion and higher rates of attrition than residential programs (Allen, Seaman, Poulin, & Straut, 2016; Kauffman, 2015). From this, one may easily assume that the proportion of distance education students shares a negative relationship with the institutional graduation or award rate. Xu and Jaggers (2013) confirmed this suspicion with their regression study using a single-state administrative dataset representing 34 community and technical colleges. The researchers observed negative estimates for students enrolled in online courses regarding both course persistence and course final grade. Xu and Jaggers (2013), however, failed to account for characteristics of the colleges and included five schools in the sample that were classified as technical colleges rather than community colleges.

Contrary to the notion supported by Xu and Jaggers's (2013) findings, Shea and Bidjerano (2014) leveraged the BPS dataset using a propensity score analysis technique and observed that 13.5% of students who enrolled in distance education coursework at a community college completed a credential within four years, as compared to 8.9% of those who did not.

Their research, though it did not consider any institutional characteristics, presents the possibility that distance education, when observed at a national scale, may not demonstrate a negative relationship with outcomes. Given the substantial population of online and distance learning students community colleges serve, this institutional characteristic is due inclusion in empirical studies.

State Characteristics

As public institutions, community colleges are subject to the policies and regulations of the state within which they operate. Furthermore, owing to their moniker and history, community colleges are closely tied to their immediate surroundings. Given that different states approach, coordinate, and fund public institutions of higher education differently and that the economic conditions within states are not homogenous, one may assume that variation within community college outcomes is partially attributable to state-level characteristics. To illustrate this, Clotfelter, Ladd, Muschkin, and Vigdor (2013) conducted a multiple regression study on the North Carolina System of Community Colleges and found that most community colleges within the state could not be statistically distinguished based on degree completion or student transfers. Horn, Horner, and Lee (2017), however, also used multiple regression techniques to assess the effectiveness of the 150% graduation rate in the community college setting. Using IPEDS data in their multivariate models to reproduce graduation rates, the researchers observed varying degrees of effectiveness in the 150% graduation rate based on state. While for most states (roughly 60 percent), the researchers found the rate to be of moderate effectiveness, community colleges in 20 states showed wider range. Taken together, these two studies imply that, when looking across all community colleges in the nation, state characteristics should not be ignored. In other words,

that which may be appropriate for community colleges or which may make them indistinguishable within a state may not hold constant across all states.

Regarding the potential influence of state-level factors, economy-related characteristics have been examined in relation to college success. Other economic factors, such as unemployment, have also received attention in the study of institutional or student outcomes (e.g., Kahn, 2010). The inclusion of such factors in the current study is grounded in an underlying hypothesis that such state-level economic factors substantially contribute to institutional outcomes.

Theoretical and Conceptual Frameworks

Two theoretical frameworks will guide this study: Human Capital Theory (HCT) and Resource Dependency Theory (RDT).

Human Capital Theory

The concept of HCT comes from the domains of business and economics, but it was Becker (1993) who first linked the concept to education. As an individual pursues training through formal education, the student adds to his or her human capital. As institutions contribute to their students' (and communities or states, likewise, to their citizens) formal education, so, too, do they invest in their supply of human capital. In this latter example, human capital may be equated with or rephrased as *talented, skilled workforce*. Based on HCT, students decide to pursue postsecondary education for the increased likelihood for higher lifetime earnings. The central precept of HCT is that a student's return of investment must outweigh the cost to pursue education. Older interpretations of HCT impress the social benefit to the individual for pursuing education, such as an improved quality of life and intergenerational benefits. More contemporary views of HCT, however, focus almost exclusively on the economic aspect. For example, Belfield

and Bailey (2011) indicated that any education beyond high school corresponded to higher earnings, as earnings seemed to rise with the accrual of academic credits and credentials.

By primarily awarding short-term credentials (i.e., two-year and less-than-two-year certificates), community colleges are uniquely positioned to promote the human capital of a state quickly and effectively. By producing graduates equipped with the necessary skills to succeed in a competitive or high-needs industry, community colleges invest into the local workforce to improve economic conditions and prosperity. Given the economic implications and concerted efforts nationwide to increase the proportion of citizens with a postsecondary credential, approaching the current study through the perspective of HCT is appropriate.

Resource Dependency Theory

Less commonly cited than HCT in educational studies is RDT. This theory is widely accredited to the work of Pfeffer and Salancik (1978). While HCT provides a rationale for the social and economic need for community colleges to improve outcomes, RDT underscores the fact that these institutions do not operate in isolation from their surroundings. From an organizational theory standpoint, community colleges are considered tightly coupled with their immediate environments. Changes or fluctuations in local economies, for example, are likely to influence community college resources, enrollments, and outcomes. The purpose in adopting an RDT perspective for this study is to underscore that community colleges operate within a social network and that their outcomes are dependent on this environment.

RDT also contains other parameters of relevance to the current study. From an institutional standpoint, the fact that an organization operates within a regulated or political system carries with it RDT-related implications. Because the pursuit of education is dependent on the perceived return on investment to the student, environmental conditions surrounding

educational institutions must certainly be considered. Community colleges are subject to the politics, practices, and regulations of the state within which they operate. For public community colleges, RDT dictates that while receiving public support safeguards resources and protects against competition, the regulations to which these institutions must bow restrains their autonomy and can make outcomes somewhat unpredictable.

Community colleges are tightly coupled with their surrounding environments. Though RDT considers community colleges as having mostly predictable patterns of resources, changes to the immediate environment may have substantial effects on community college enrollments, outcomes, and funding.

Conceptual Framework

While HCT and RDT provide the theoretical basis for this study, the selection of independent variables, which will be discussed in greater detail in the following chapter, will be guided by a conceptual framework established in prior research. In a study from the Community College Research Center at Teachers College, Columbia University, Calcagno et al. (2008) set out to determine the effects that certain institutional factors had on community college success. The framework designed for their study examined general institution characteristics (such as mission and degree of urbanicity), compositional characteristics (the demographic makeup of an institution), and the financial characteristics (a determination of the wealth and investments of an institution) in relation to graduation rates of community colleges across the nation. As discussed previously, this framework is incomplete, because it omits important contextual characteristics of community colleges. This study, therefore, will adopt a modified and expanded version of this conceptual framework.

Summary

This chapter sought to provide an overview of what is known about the relationship between the institutional characteristics and the outcomes at community colleges and to establish the theoretical and conceptual frameworks guiding the current study. Institutional characteristics typically included in quantitative studies on community colleges outcomes fall into three broad categories: general characteristics, student enrollment characteristics, and institutional resources and expenditures. General characteristics include the degree of urbanization, institutional size, and institutional type. Student enrollment characteristics reflect the proportional enrollment of gender, race, age, part-time enrollment, and financial aid (especially Pell Grant) recipients. Less commonly examined but salient to student enrollment characteristics is distance education enrollment. Institutional resources and expenditures typically include the proportion of part-time faculty members and the amounts per full-time equivalent student invested into the core expenses of instructional, academic, student, and institutional services. Prior studies have also indicated potential differences between states on community colleges and performance.

Taken together, these characteristics form the conceptual framework, the selection and grouping of independent variables, to be included in the current study. This will be discussed in greater detail in the following chapter on research methodology and data sources. Two theoretical frameworks will be adopted for this study: Human Capital Theory (HCT) and Resource Dependency Theory (RDT). Through HCT, which underscores the economic importance and benefit to pursuing postsecondary education, this study may be positioned into the current social and political context surrounding community college outcomes. RDT, which argues the inseparability of an organization and its productivity from its environment, provides

the credence for this study to consider environmental (i.e., state) characteristics in concert with characteristics of the institutions themselves.

CHAPTER III

RESEARCH METHODS

The purpose of this study is to investigate how institutional and state characteristics of community colleges predict award rates. The research will constitute a quantitative approach to studying a vital community college outcome by means of a more robust selection of explanatory variables and more appropriate method of analysis. The following three research questions will guide this study:

1) Which institutional characteristics significantly influence community college award rates?
2) How do community college award rates vary across states?
3) Which institutional characteristics significantly influence community college award rates after accounting for state-level characteristics?

The following chapter provides a discussion of the data sources and methods of data preparation and analysis related to this study.

Data Sources

Data for this study will come from three publicly available sources: the National Center for Education Statistics (NCES), the Bureau of Labor Statistics (BLS), and the United States Census Bureau (Census). The following paragraphs outline the databases maintained by these agencies for which data will be extracted for use in this proposed study. In addition to a description of the databases, commentary on the data collection and cleaning procedures will also be discussed.

Integrated Postsecondary Education Data System

The primary data source for this study is the Integrated Postsecondary Data System (IPEDS). In accordance with the Higher Education Act of 1965, all postsecondary institutions accepting federal student aid dollars must provide data on a variety of topics to IPEDS, which is maintained by the National Center for Education Statistics (NCES). Data submitted to IPEDS are collected three times within an institution's academic year: fall for institutional characteristics, completion data, and annual enrollments; winter for admission data, graduation rates, outcome measures, and financial aid data; and spring for prior fall enrollment, institutional finances, human resources, and library data (IPEDS, 2018). Once published, IPEDS data are publicly available. As such, it is of some importance to note that not all data in IPEDS are representative of the same point in time for postsecondary institutions. For the proposed study, the dependent and institution-level independent variables will be extracted from IPEDS.

Bureau of Labor Statistics

The Bureau of Labor Statistics (BLS) is a federal agency operating under the United States Department of Labor. BLS collects and publishes data to the general public relating to economic activity across the nation. Maintained by BLS, the Local Area Unemployment Statistics Program (LAUS) provides monthly and yearly estimates of employment-related statistics for regions (e.g., cities, counties, and states) across the United States (BLS, 2020). For the proposed study, data on state-level unemployment rates will be sourced from BLS's Local Area Unemployment Statistics (LAUS) database.

United States Census Bureau

As implied by the agency's title, the United States Census Bureau's (Census) foundational role is to coordinate and to conduct the decennial census. To supplement the data

collected every ten years on the population of the United States, the Census conducts the annual American Community Survey (Census, 2020). Like IPEDS and BLS, the data from ACS are public facing once published online. For the proposed study, the median household income by state will be extracted from the Census's ACS database.

Sample Selection

IPEDS contains data for all postsecondary institutions in the United States and its territories that participate in federal student aid programs. Within IPEDS, the institutions to be included in this study will be from the two-year, public sector in the 2018 data file. At the time of this study, the 2018 data file is the most recent issue of IPEDS data and is under preliminary release status. Based on the 2018 data file and the aforementioned delimitation by sector, data from a total of 968 institutions will be extracted from IPEDS. From this total, however, further exclusions will be made to remove institutions within outlying economic regions (e.g., Puerto Rico and Guam). The resulting dataset, after exclusions, will include a base of 839 community colleges.

Furthermore, the degree to which data are missing in any field for any institution must be considered. For both regression techniques to be used in this study, if a case (i.e., institution) contains any degree of missing data, the regression formulas cannot be calculated (Raudenbush & Bryk, 2002). While several methods exist for the accounting of missing data, this study will exclude cases by means of listwise deletion, which will exclude any cases containing missing data for any variable. While listwise deletion will produce a complete dataset, the caution with using this technique is the risk of reducing analytical power (Little, 1992). Data fields left blank in the database indicate that the institution provided no response to that respective survey item While multiple imputation, a method for estimating the values of missing data, is often seen as a

desirable method, it may not be the most appropriate for IPEDS data. Data collection in IPEDS involves validation processes, including institutional follow-up inquiries (IPEDS, 2018). Missing data in IPEDS may not be considered missing at random. In other words, institutions may lack values for reasons beyond data entry error. Multiple imputation techniques would assign values to institutions for information they may have purposefully or reasonably omitted. Therefore, to account for methodological requirements and to preserve the integrity of the institutions within the dataset, this study will leverage listwise deletion. By means of listwise deletion, a total of 821 cases will be included in this study, which represents roughly 85 percent of all two-year institutions in IPEDS.

These institutions are distributed across 46 states, which represent the grouping structure, or the level-two units. Summary of the award rates by state is available in Table 6.1 of Appendix A. Based on how institutions are classified in IPEDS (i.e., community colleges not being grouped under the sector of two-year, public institutions), the states of and institutions within Alaska, Delaware, and Nevada will not be included in the sample data. Due to missing data in IPEDS, the single two-year institution listed for Indiana will be omitted. No cases are observed to be missing data at the state level.

Variables

Dependent Variables

While past studies using IPEDS data have often used the three-year (150%) graduation rate—which is based on cohorts of first-time, full-time freshmen—as the measure of degree completion, Bailey (2012) noted that this variable is not representative of the majority of community college students and of the variation of their entering students. In an earlier study, Dellow and Romano (2002) echoed similar statements in their anecdotal evidence from Broome

Community College in New York, in which the graduation rate was contingent only on 3 students in a class of over 50 graduates.

Three dependent variables will be used in the proposed study to represent degree attainment at community colleges: the four-year award rates for first-time students, for not-first-time students, and for all students. These data will be extracted from the 2018 Outcomes Measures data file in IPEDS and will reflect the 2010-2011 adjusted cohort of entering community college students. Outcomes measures are a recent addition to the IPEDS surveys and contain the four-, six-, and eight-year outcomes of entering students. For the 2018 data file, the outcomes measures are contingent on the 2010-2011 cohort. These variables represent the proportion of students who received any credential within a four-year period of enrolling. Table 3.1 below presents the descriptive statistics for the descriptive variables, including the count of institutions reporting outcomes measures, standard deviations, and minimum, maximum, and average award rates.

Beginning with the 2017 data file, IPEDS included the outcomes measures for entering cohorts. While the outcomes measures relating to community colleges have received some descriptive study (e.g., Juszkiewicz, 2017), no study has yet leveraged these data in an inferential or multivariate manner. Prior to 2017, award (or graduation) rates used the cohort of first-time, full-time freshmen (FTFTF) as the denominator. As previously established, the annual cohort of FTFTF constitutes a limited means of assessing community college outcomes. Using the new outcomes measures in IPEDS, however, the denominator may be adjusted to distinguish between first-time and not-first-time students or to include all entering students. To provide a more comprehensive view of how institutional factors predict community college outcomes, the proposed study will leverage this ability to distinguish the denominator and will include the

Table 3.1. Descriptive Statistics of Four-Year Award Rates

Dependent Variable	N	Min	Max	Mean	Std. Deviation
All Entering Students	821	3.00	84.00	22.75	10.28
First-Time Students	821	3.22	86.69	20.74	9.98
Not-First-Time Students	821	0.00	90.68	25.96	11.99

**All DVs represent the entering cohort of students in academic year 2010-2011*

award rates for all three classifications of entering students as dependent variables. The scope of outcome measures available in IPEDS includes the proportions of the adjusted cohort that transferred, remained enrolled, earned a credential, or have an unknown status within four, six, and eight years after enrolling. The proposed study will only assess the four-year award rates for the adjusted cohort, which may be loosely equated to a 200 percent graduation rate for community colleges.

Independent Variables

The independent, or explanatory, variables for this study are measured at two levels, institution (or level-one) variables and state (or level-two) variables.

Institution-level variables. Data measured at the first level will represent institutional characteristics. The variables will come from a combination of the 2018, 2014, 2013, 2012, and 2011 data files in IPEDS. Table 3.2 below displays the descriptive statistics for the independent variables measured at the institutional level. These variables are grouped into three categories: institutional background characteristics, institutional student enrollment characteristics, and institutional resources and expenditures. Due to data availability limitations in older years of IPEDS data, some institutional characteristics are extracted from the 2018 data file.

Based on the literature review presented in the previous chapter, this study's selection of independent variables will be grouped into three categories: general characteristics, student enrollment characteristics, and institutional resources and expenditures. For the block-entry approach to the OLS regressions (discussed later in this chapter), variables will be entered into the regression formula in these groups and in the order specified.

The general characteristics of institutions will include measures of institutional size, degree of urbanization, institutional type, and multi-institutional control. Institutional size,

institutional type, and multi-institutional control come from the 2018 data file in IPEDS, and the degree of urbanization will be captured as a four-year average of the values reported in the 2011, 2012, 2013, and 2014 data files. For this study, institutional size will be a dummy coded categorical variable indicating whether the institution enrolled fewer than 5,000 students or greater than or equal to that amount.

The degree of urbanization is an ordinal variable ranging from most rural to most urban. Because the immediate surroundings of institutions may become increasingly more urban with time (thereby evoking a change in the degree of urbanization), an average of this variable was taken. If no shifts in urbanization were experienced over the observation period, the average score should equal the observed scores in the individual year files. The alterative would be to treat this variable as categorical (i.e., collapsing the degree of urbanization into groups, dummy coding, and comparing against a reference group), which would assume that the degree of urbanization is constant (i.e., unchanging). Over the course of the observation period, some community colleges reported increases to the degree of urbanization, which demonstrates the dynamic nature of this variable. Treating it as a static category may inadvertently bias results.

The multi-institutional control is a dichotomous variable which serves as an indication of whether the institution is part of a larger, multi-institutional organization. Including the multi-institutional control variable echoes this study's RDT theoretical framework, because institutions that operate under a larger organization may have access to more resources and may be subject to additional regulations. Likewise, community colleges that are not part of a multi-institutional organization may have more autonomy in institutional decision making.

The student enrollment characteristics in this study will be the proportional composition of the undergraduate student body at the institutions. These characteristics will include the

proportion of female students, underrepresented minority students (defined as a combination of the proportions of Black or African American students, Hispanic students of any race, and Native American students), adult students (defined as students over the age of 24), non-degree-seeking students, Pell Grant recipients, and students participating in online coursework (i.e., in at least one online course). For each of these variables a four-year average was derived. Due to year-to-year changes in the scope of data collected by means of IPEDS surveys, institutions were not surveyed on the number of online students enrolled for the 2011 data release. As such, all institutions were missing values for this field in 2011. To calculate a four-year average, the missing values will be replaced with the values the institutions reported in 2012.

The third group of independent variables includes measures of institutional resources and expenditures. Institutional resources will include the proportion of part-time faculty members and institutional revenues from tuition and fees and from state appropriations. All institutional revenues and expenditures are reported as the values per full-time equivalent (FTE) student. These financial variables have also been adjusted for inflation and scaled to values of one-thousand dollars.

Group-level variables. Variables measured at the second (or group) level will represent state economic conditions: unemployment rates and the median household income. In this study, unemployment rates are presented as the average proportion of the state's labor force without employment. While unemployment rates act as a measure of joblessness within the state, the median household income is a measure of wealth. Owing to the tightly coupled relationship community colleges share with their environments and to the effects of the Great Recession of 2008, state economic conditions may influence the performance of community colleges.

Table 3.2. Descriptive Statistics, Independent Variables

Variable	Label	Count	%	Mean	Std. Deviation
General Characteristics					
Institution Size	Student Enrollment < 5,000 Students*	465	56.6		
	Student Enrollment >= 5,000 Students	356	43.4		
Institution Type	High Transfer*	313	38.1		
	High Career & Technical	213	25.9		
	Mixed	295	35.9		
Multi-Institution Control	Part of a Multi-Institution Organization	510	62.1		
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)			6.7	3.4
Student Enrollment Characteristics					
Percent Part-Time Enrollment	Continuous			58.0	12.8
Percent Adult Student Enrollment	Continuous			32.2	11.4
Percent Non-Degree Seeking Enrollment	Continuous			19.2	12.8
Percent Black, Hispanic, Native American	Continuous			29.5	21.3
Percent Female Enrollment	Continuous			58.1	7.1
Percent Pell Enrollment	Continuous			42.1	13.9
Percent of Students in Distance Education	Continuous			30.1	15.4
Resources & Expenditures					
Percent Part-Time Faculty	Continuous, Adjusted for Inflation			61.0	16.6
Revenue from Tuition and Fees**	Continuous, Adjusted for Inflation			2.4	1.4
Revenue from State Appropriations**	Continuous, Adjusted for Inflation			3.8	2.2
Instructional Expenditures per FTE**	Continuous, Adjusted for Inflation			5.9	1.9
Academic Services Expenditures per FTE**	Continuous, Adjusted for Inflation			1.2	0.7
Student Services Expenditures per FTE**	Continuous, Adjusted for Inflation			1.5	0.8
Institutional Services Expenditures per FTE**	Continuous, Adjusted for Inflation			2.2	1.1
State Characteristics					
Unemployment Rate	Continuous			7.5	1.4
Median Household Income**	Continuous			56.7	8.4

Notes: All continuous variables are four-year averages
* Reference group
** Scaled to values of $1,000

Data Cleaning and Preliminary Analyses

Prior to conducting a multilevel analysis, data files are to be merged and cleaned within SPSS (version 24). Data cleaning will involve the calculation of four-year averages for all continuous variables. This method is consonant with Cheslock's (2005) approach to accounting for substantial year-over-year fluctuations in any particular data field. The categorical variables of institutional type and size will come directly from the 2018 data file and will be dummy coded prior to entering them into the regression equations (Table 3.2 denotes the reference groups for dummy coded variables).

Of special note, all financial variables will undergo two types of manipulation in addition to the creation of four-year averages. To account for a recovering national economy after the financial crisis of 2008 and the Great Recession, all financial variables will be adjusted for inflation using the Higher Education Pricing Index (HEPI). Developed specifically for colleges and universities, HEPI will serve as a more accurate means of adjusting for inflation than BLS's Consumer Price Index (Commonfund Institute, 2019). These adjustments will be made before the calculations of four-year averages. By adjusting for the inflation rates, dollar amounts across years will be equated to the dollar values of 2018. Leveraging the data in this fashion will make interpreting the influence of financial characteristics more meaningful and relatable. Also, to make the output more interpretable, these values will be scaled to units of $1,000.

From the resulting dataset, three preliminary analyses will be conducted to assess for missingness, multicollinearity, and the presents of multivariate outliers. As reported earlier, listwise deletion will be used to produce a complete dataset. While listwise deletion can lead to a loss of power in multilevel analyses if level-two units are missing data (Baraldi & Enders, 2010), no level-two variables were found to have missing data.

To assess for multicollinearity, variance inflation factors (VIF) will be assessed for each predictor variable using the collinearity diagnostics of a preliminary ordinary least squares (OLS) regression. According to Ethington, Thomas, and Pike (2002), VIF values of 10 or greater indicate the problematic presence of multicollinearity, though other sources have recommended more conservative estimates of VIF (e.g., greater than 5). If multicollinearity is evident, additional data manipulations may be required, or independent variables may be excluded.

To assess the data for influential outliers, Cook's Distance and Mahalanobis Distance statistics will be reviewed (Loy & Hofmann, 2013). These tests take into consideration the leverage and influence of individual cases on the regression line and are used to indicate extreme values in a multivariate analysis (Osborne, 2013). If institutions are identified as multivariate outliers, the question of what to do about them will come to the forefront. A multitude of methods exists for the treatment of extreme scores. In general, these methods may be summed into three types of decisions regarding how to account for outliers: ignoring them, removing them, or manipulating (e.g., trimming or winsorization) them. For the proposed study, the statistical analyses will be performed with and without any multivariate outliers to observe their effect on the regression results (i.e., unstandardized coefficients, standardized coefficients, and significance) (Osborne, 2013).

Along with the data cleaning procedures outlined above, the statistical assumptions of normality and homoscedasticity must also be assessed after the regression analyses are conducted. In other words, the level-one and level-two residuals (i.e., the error terms) should have a normal distribution and a constant variance (Snijders & Bosker, 2012). This will be accomplished by plotting the unstandardized and standardized residuals at both levels against the independent variables (Snijders & Bosker, 2012). If there is evidence of non-normality or

heteroscedasticity, the dependent variables may be transformed using a natural logarithm so that these statistical assumptions may be met (Snijders & Bosker, 2012). While nonlinear transformations aid in the correction of non-normal data, transformed variables require different and more complex interpretations.

Methods

This study will make use of two analytical methods: an ordinary least squares (OLS) and multilevel regressions.

OLS Regression

To address the first question, three separate OLS regressions will be calculated: one for each of the dependent variables. The term OLS is a reference to how the population parameters are estimated via this method. In OLS regressions, population parameters are estimated by minimizing the sum of squared residuals (Wooldridge, 2013). While it is certainly possible to study the effect of each individual covariate on the dependent variables through several, separate simple (or bivariate) regressions, the use of an OLS regression permits for the simultaneous inclusion (i.e., control) of all covariates and will allow for causal inference to be made (Wooldridge, 2013). The three OLS regressions will be calculated using the Equation 1 below:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \ldots \beta_i x_i + e. \quad (1)$$

In this equation, *y* represents the dependent variable (award rates of community colleges). The first coefficient (β_0) stands for the intercept, the value of which may be interpreted as the award rate when all covariates equal zero. The remaining coefficients (β_1 through β_i) denote the population parameters calculated for each independent variable included in the model. The values of *x* (x_1 through x_i) represent the values of the independent variables for each individual community college. The remaining portion of the equation is an error term, *e*, which represents

the difference (or distance) between the observed value in the dataset and the predicted value on the regression line.

Multilevel Regression

To address the second and third questions, separate multilevel analyses will be conducted for each of the three dependent variables. Multilevel modeling, or hierarchical linear modeling, is an extension of linear regression and offers a means through which researchers can account for the grouping structure of nested data and to assess for the influence of group-level variables on individual-level outcomes (Hox, Moerbeek, & van de Schoot, 2018; Raudenbush & Bryk, 2002). An assumption of inferential statistics is that individual observations are independent of one another. In the social sciences, this generally held assumption is almost always violated (Heck, Thomas, & Tabata, 2014; Hox et al., 2018). By ignoring the grouping structure in nested data, researchers may underestimate standard errors and calculate false statistical significance in their findings, also known as a Type I error (Hox et al., 2018). Multilevel modeling offers researchers a means of holding the grouping structure constant.

Multilevel modeling is conducted in three general phases: the specification of the null model, specification of the first level, and specification of the second level (Heck et al., 2014). To facilitate and guide the construction of the final multilevel model, the procedures outlined by Peugh (2010) and Heck, Thomas, and Tabata (2014) were followed regarding cross-sectional multilevel modeling procedures. The following paragraphs describe the progression of the model using Peugh's recommendations, beginning with the estimation of the unconditional model, the level-one model, and the level-two model. To estimate the population parameters, this study will employ a full maximum likelihood estimation (FML; Hox et al., 2018).

Unconditional model. For purposes of this study, the null or unconditional model will serve two purposes: to validate the need to conduct a multi-level modeling technique and to address the second research question. To justify the need for a multilevel approach, an examination of the intraclass correlation (ICC) and the design effects (DE) are requisite (Hox et al., 2018). The ICC refers to "the proportion of the total variance explained by the grouping structure in the population" (Hox et al., 2018, p. 13). This statistic will be calculated for each dependent variable using Equation 2 below:

$$\rho = \sigma_B^2/(\sigma_B^2 + \sigma_W^2) \quad (2)$$

In basic terms, the ICC (ρ) is equal to the between-group variance (σ_B^2) divided by total variance (represented as the sum of the between- and within-group variance). Using the ICC, the DE, which Peugh (2010) described as a quantification of the degree to which the independence of errors statistical assumption is violated, may be calculated using the following formula: DE=1+(n_c-1) ρ. In this formula, n_c is a ratio representing the count of level-one units divided by the count of level-two units. Based on the sample data, n_c equals 17.85, which equates to an average of approximately 18 community colleges per state.

If the ICC indicates a substantial proportion of explainable variance and if the DE value exceeds two, the need for a multilevel model is evidenced (Peugh, 2010). To calculate both the ICC and the DE, the unconditional model will be estimated, which will be estimated using only the dependent variables (Hox et al., 2018). Using the ICC and the DE, this study's second research question may be addressed.

Because this study will leverage FML estimation to produce the population parameters, model fit, or the quantified measure of how well the statistical model accounts for variation in the dataset, may be assessed by means of the deviance statistic (Heck et al., 2014). This statistic

will be first calculated as part of the unconditional model, then recalculated with each new iteration of the statistical model. A representation of good model fit will be assessed by a chi-square (χ^2) test for a statistically significant reduction in the deviation score from model to model (Heck et al., 2014; Hox et al., 2018).

Level-one model. Following the unconditional model, the first level of the multilevel model will represent the institution-level data. Equation 3 below illustrates how the level-one model will be designed:

$$y_{ij} = \gamma_{00} + \gamma_{10}x_{1j} \ldots \gamma_{n0}x_{nj} + u_{0j} + \varepsilon_{ij} \quad (3)$$

In the formula, y_{ij} represents the award rate for an individual community college (*i*) within a state (*j*). The parameter γ_{00} represents the state-level intercept. Through grand mean centering, which will be discussed in the following paragraph, this may be interpreted as the average award rate for all community colleges across all states. Each parameter (γ_{01} through γ_{0n}) represents the state-level slopes associated with the covariates (x_{1j} through x_{nj}) The formula includes two error terms, u_{0j} (which represents the variation from the grand mean) and ε_{ij} (which may be equated to the statistic *e* in Equation 1). The results of the level-one model should not deviate substantially from the OLS regression model (Equation 1) used to address the first research question. Any changes in the results will likely be due to the differences between population estimates generated through OLS and FML techniques.

To build the first level, all independent variables except for those which were dummy coded were centered on the grand mean. Centering rescales the independent variables in order to give the value zero (and subsequently the model intercept) a meaningful interpretation (Hox et al., 2018). When building a multilevel model, centering is an essential step because "hierarchical linear models use the level-1 parameters as outcome variables in the level-2 analysis" (Hofmann

& Gavin, 1998, p. 626). Because the study was substantively interested in the inclusion of level-two variables to an expanded conceptual model, the choice was made to center variables on the grand mean versus the group mean (Enders & Tofighi, 2007). Categorical independent variables were dummy coded (i.e., rescaled to 0 or 1) and were entered into the model uncentered because the value zero already had a meaningful interpretation.

Level-two model. In the second model, independent variables representing state economic factors were introduced to the equation. Equation 4 expands upon Equation 3 through the inclusion of the state-level unemployment rate (UR) and median household income (MHI).

$$y_{ij} = \gamma_{00} + \gamma_{01}UR_j + \gamma_{02}MHI_j + \gamma_{10}x_{1j} \dots \gamma_{n0}x_{nj} + u_{0j} + \varepsilon_{ij} \quad (4)$$

Due to the final inclusion of state- and institution-level covariates, this formula may also be referred to as the mixed model. Like the predictors included in level one, the level-two variables were centered on the grand mean (Hofmann & Gavin, 1998). Including the level-two independent variables to explain variations in the intercept altered the interpretation of the intercept. Extending the interpretation of the level-one intercept, the inclusion of level-two factors modified the intercept to represent the award rate for community colleges in states with grand average unemployment rates and grand average household incomes. Using the level-two model results, the third research question may be addressed.

Summary

The purpose of this chapter was to establish the data sources, dependent and independent variables, research methods, and data cleaning and analytic techniques. Data for this study come from three sources: the Integrated Postsecondary Education Data System (IPEDS), the Bureau of Labor Statistics (BLS), and the United States Census Bureau (Census). This study will assess three dependent variables sourced from IPEDS: the award rates for all entering students, first-

time students, and not-first-time students from the 2010-2011 cohort of community college entrants. The independent variables reflect the conceptual framework introduced in Chapter II and represent into two types, level one (institutional characteristics) and level two (group or state characteristics).

This study will make use to two primary statistical methods to address the research questions. For the first research question, ordinary least squares (OLS) regressions will be performed for each of the three dependent variables to determine which institutional characteristics are significantly related to community college award rates. For the second and third research questions, multilevel modeling techniques will be leveraged. To address the second research question, the intraclass correlation coefficients (ICC) and design effects (DE) will be calculated for each dependent variable to illustrate how community college award rates vary across states and how problematic quantitative studies on these outcomes become if the grouping structure (differences between states) is ignored. Similar to the first research question, the final research question will assess which institutional characteristics are significantly related to community college award rates, once state characteristics are taken into account. To prepare for analysis, the data will be assessed to verify that statistical assumptions of multivariate normality, absence of outliers, and homoscedasticity are not seriously violated. The independent variables will also be assessed to ensure there are no problematic instances of multicollinearity. The results of these procedures and analyses are presented in the following chapter.

CHAPTER IV

RESULTS

This dissertation study investigated the linkages between institutional and state characteristics and community colleges award rates. By means of an expanded conceptual model and the application of a more appropriate statistical method for assessing community colleges on a national scale, this study aimed to fill a substantial gap in the current literature on community college outcomes. Data for this study came from the Integrated Postsecondary Education Data System (IPEDS), the Bureau of Labor Statistics (BLS), and the United States Census Bureau. Three research questions guided this study:

1) Which institutional characteristics significantly influence community college award rates?
2) How do community college award rates vary across states?
3) Which institutional characteristics significantly influence community college award rates after accounting for state-level characteristics?

To answer these questions, two primary statistical methods were employed. For the first question, an ordinary least squares (OLS) regression was applied to the four-year award rates for all entering students, first-time students, and not-first-time students of the 2010-2011 cohort of community college matriculants. The second and third research questions employed multilevel modeling techniques of the same dependent variables.

The purpose of this chapter is to delineate the results from the statistical analyses described in the preceding chapter. This chapter's contents are divided into two main parts, the preliminary analyses and the primary analyses. The preliminary analyses include the assessments

for data requirements and potential statistical assumption violations. The primary analyses include the results of the regression analyses and are presented by research question.

Preliminary Analyses

Preliminary analysis of the dataset began with assessing for the presence of multivariate outliers and of problematic evidence of multicollinearity, a condition in which two or more independent variables are highly related to each other. Multivariate outliers were assessed by a review of Cook's distance statistics, a measurement of how much influence a data point has on the regression line, and of Mahalanobis distance statistics, which provide a measurement of distance between points in a multivariate space. Both statistics were based on the residuals generated from preliminary OLS regressions of each dependent variable. These analyses identified a total of 27 institutions as potential multivariate outliers for all three dependent variables. Indeed, the presence of these institutions corresponded to changes in both the standardized and unstandardized regression coefficients. These institutions were removed from further analysis. After removing these cases, the total sample size for the study decreased to 792. The count of states included in the sample (i.e., the level-two sample size for the multilevel models) did not decrease with the removal of multivariate outliers. A revised table of descriptive statistics for the dependent and independent variables is presented in Appendix C.

To assess for the problematic effects of multicollinearity, variance inflation factors (VIF) were assessed as a part of preliminary OLS regressions. VIF statistics ranged from 1.02 (Percent Part-Time Faculty) to 2.30 (Percent Pell Enrollment). As a point of reference, Ethington et al. (2002) recommended VIF values greater than or equal to 10 as indication of problematic multicollinearity. None of the independent variables included in this study exhibited such

evidence. VIF and tolerance (the inverse of VIF) statistics are presented for each independent variable in Table 6.4 in Appendix D.

In the next phase of preliminary analyses, the statistical assumptions of normality and homoscedasticity were assessed. Beginning with the statistical assumption of multivariate normality, this was assessed by reviewing Q-Q plots of the residuals for each of the three dependent variables. Through this assessment, the dependent variables representing the award rates for all entering students and for first-time students appeared to have mild violations of the normality assumption. Figure 6.1 in Appendix E illustrates these variables' departures from normality. The third dependent variable, not-first-time student award rates, did not present any alarming evidence that the assumption was violated.

Along with assessing normality, the dependent variables were also assessed for potential violations of the homoscedasticity assumption, or the assumption of constant variance. Through reviews of scatterplots of the residuals (also presented in Figure 6.1 in Appendix E), the same two dependent variables that exhibited potential violations from the normality assumption also demonstrated patterns indicative of heteroscedasticity.

To correct for these assumption violations, the first two dependent variables required transformation. This was accomplished by means of a log transformation. This means that the regression formulas presented in Chapter III required slight modification. To illustrate, the OLS regression formula (formula 1 in the preceding chapter) became the following for the two transformed dependent variables:

$$\ln(y) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \ldots \beta_i x_i + e. \quad (5)$$

where ln(y) represents the natural logarithm applied to the dependent variable. Through a comparison of the scatterplots from before the transformation to those after (Figure 6.2 in

Appendix F), the transformation appears to correct the violations to multivariate normality and homoscedasticity.

The third dependent variable, award rates for not-first-time students, did not exhibit the same evidence of assumption violations. While it would be tempting to log transform this dependent variable so it could be interpreted in the same fashion as the other two, arbitrarily transforming a dependent variable could inadvertently create outliers (Wooldridge, 2013). Moreover, the third dependent variable contained one case with a value of zero. Because a natural logarithm cannot be mathematically calculated for values of zero, formula 5 presented above would have to be modified to ln(1+y). By its own definition, however, ln(1+y) cannot be normally distributed (Wooldridge, 2013). A transformation applied to this variable seemed to cause it to violate the multivariate normality assumption (see Figure 6.1 in Appendix E). Because of these issues related to transformation, the award rates for not-first-time students were not transformed for the primary analyses. To offer a direct comparison of results to the other two dependent variables, however, the results of both the OLS and multilevel regressions using a log transformed version of the not-first-time student award rates are presented in Appendix H.

Untransformed, the unstandardized coefficients in the regression analyses would be interpreted as a one-unit increase in the dependent variable for a one-unit increase in the independent variable. For the analyses, this interpretation applies only to the award rates for not-first-time students. Transformed, the unstandardized coefficients are interpreted as a percent increase in the dependent variable for a one-unit increase in the independent variable. The award rates for all entering and first-time students adhere to this interpretation. Readers are encouraged to be mindful of the difference in interpretation between the first two dependent variables and the third.

Primary Analyses

Which institutional characteristics significantly influence community college award rates?

To address the first research question, OLS regressions were conducted for each of the three dependent variables. The regression results for award rates for all entering students are presented below in Table 5.2, award rates for first-time students are presented in Table 5.3, and award rates for not-first-time students are presented in Table 5.4. The unstandardized coefficients (*b*) indicate the change in the dependent variable for a one-unit change in the independent variable. The standardized coefficients, represented by beta (β), act as a measure of effect size and indicate the magnitude of the relationship between the dependent and independent variables within the regression model. The tables below present the coefficients carried out to the thousandth digit. For instances in which coefficient values were smaller than this decimal placement, statistics were reported using scientific notations. The negative exponent (the numeric value following *E* in the notation) of these scientific notations represents the number of places to the left the decimal should shift. To illustrate the use of scientific notations, the unstandardized coefficient for the percent of Pell Grant student enrollment in Table 4.1 is reported as 4.555E-05, which is the equivalent of 0.00004555.

Because of the logarithmic transformation applied to the award rates for all entering and first-time students, the regression outputs carry a different interpretation from the award rates for not-first-time students. The transformation applied to these variables makes the unstandardized coefficients less meaningful to interpret. By exponentiating (the opposite of a logarithm) the unstandardized coefficients using the general formula, *Exp(b)-1*, and multiplying the result by 100, the coefficients are interpreted as a percent change in the dependent variable for a one-unit increase in the independent variable (Wooldridge, 2013). The reader will undoubtedly notice that

Table 4.1. OLS Regression Results for All Entering Students Award Rates

Variable	Label	b	Exp(b)-1	Std. Error	β	*t*	Sig	R^2
Constant		3.930		0.165		23.829	***	
General Characteristics								0.198
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.010	-0.010	0.005	-0.078	-2.001	**	
Institution Size	Student Enrollment >=5,000 Students	0.015	0.015	0.035	0.017	0.422		
Institution Type	High Career & Technical College	0.277	0.319	0.034	0.285	8.046	***	
	Mixed Career & Technical / Transfer College	0.064	0.066	0.029	0.073	2.245	**	
Multi-Institution Control	Part of a Multi-Institutional Organization	0.062	0.064	0.027	0.071	2.318	**	
Student Enrollment Characteristics								0.358
Percent Part-Time Enrollment	Continuous	-0.009	-0.009	0.001	-0.269	-6.806	***	
Percent Adult Student Enrollment	Continuous	-0.001	-0.001	0.001	-0.038	-1.144		
Percent Non-Degree Seeking Enrollment	Continuous	0.005	0.005	0.001	0.151	4.509	***	
Percent Black, Hispanic, Native American	Continuous	-0.005	-0.005	0.001	-0.227	-6.272	***	
Percent Female Enrollment	Continuous	-0.010	-0.010	0.002	-0.136	-3.930	***	
Percent Pell Enrollment	Continuous	4.555E-05	4.56E-05	0.001	0.001	0.035		
Percent of Student Enrolled in Distance Education	Continuous	0.001	0.001	0.001	0.041	1.263		
Resources & Expenditures								0.377
Percent Part-Time Faculty	Continuous	0.001	0.001	0.001	0.022	0.778		
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	-0.033	-0.032	0.011	-0.100	-2.914	***	
Revenue from State Appropriations	Continuous, Adjusted for Inflation	-0.001	-0.001	0.007	-0.004	-0.109		
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.025	0.025	0.010	0.093	2.579	***	
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.014	-0.014	0.022	-0.022	-0.650		
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.016	0.016	0.020	0.026	0.776		
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.035	0.035	0.016	0.075	2.186	**	

Note. *p<0.10; **p<0.05; ***p<0.01

Table 4.2. OLS Regression Results for First-Time Student Award Rates

Variable	Label	b	Exp(b)-1	Std. Error	β	*t*	Sig	R^2
Constant		4.212		0.176		23.993	***	
General Characteristics								*0.180*
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.009	-0.009	0.005	-0.066	-1.672	*	
Institution Size	Student Enrollment >=5,000 Students	0.005	0.005	0.037	0.006	0.147		
Institution Type	High Career & Technical College	0.303	0.354	0.037	0.295	8.271	***	
	Mixed Career & Technical / Transfer College	0.073	0.076	0.030	0.079	2.407	**	
Multi-Institution Control	Part of a Multi-Institutional Organization	0.121	0.129	0.028	0.132	4.279	***	
Student Enrollment Characteristics								*0.347*
Percent Part-Time Enrollment	Continuous	-0.010	-0.010	0.001	-0.279	-7.012	***	
Percent Adult Student Enrollment	Continuous	-0.004	-0.004	0.001	-0.100	-2.964	***	
Percent Non-Degree Seeking Enrollment	Continuous	0.003	0.003	0.001	0.093	2.745	***	
Percent Black, Hispanic, Native American	Continuous	-0.005	-0.005	0.001	-0.231	-6.336	***	
Percent Female Enrollment	Continuous	-0.009	-0.009	0.003	-0.123	-3.523	***	
Percent Pell Enrollment	Continuous	-0.003	-0.003	0.001	-0.088	-2.049	**	
Percent of Student Enrolled in Distance Education	Continuous	2.85E-04	2.85E-04	0.001	0.010	0.298		
Resources & Expenditures								*0.368*
Percent Part-Time Faculty	Continuous	1.10E-04	1.10E-04	0.001	0.004	0.144		
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	-0.051	-0.050	0.012	-0.148	-4.267	***	
Revenue from State Appropriations	Continuous, Adjusted for Inflation	0.001	0.001	0.008	0.006	0.166		
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.014	0.014	0.010	0.051	1.408		
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.026	-0.026	0.024	-0.038	-1.113		
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.003	0.003	0.022	0.005	0.135		
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.045	0.046	0.017	0.092	2.657	***	

Note. *p<0.10; **p<0.05; ***p<0.01

Table 4.3. OLS Regression Results for Not-First-Time Student Award Rates

Variable	Label	b	Std. Error	β	*t*	Sig	R^2
Constant		37.962	4.537		8.367	***	
General Characteristics							0.196
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.293	0.135	-0.085	-2.170	**	
Institution Size	Student Enrollment >=5,000 Students	0.551	0.955	0.024	0.577		
Institution Type	High Career & Technical College	7.143	0.946	0.266	7.547	***	
	Mixed Career & Technical / Transfer College	1.068	0.788	0.044	1.355		
Multi-Institution Control	Part of a Multi-Institutional Organization	0.561	0.732	0.023	0.766		
Student Enrollment Characteristics							0.347
Percent Part-Time Enrollment	Continuous	-0.182	0.038	-0.189	-4.808	***	
Percent Adult Student Enrollment	Continuous	0.008	0.035	0.007	0.215		
Percent Non-Degree Seeking Enrollment	Continuous	0.185	0.031	0.200	6.002	***	
Percent Black, Hispanic, Native American	Continuous	-0.094	0.020	-0.169	-4.690	***	
Percent Female Enrollment	Continuous	-0.320	0.068	-0.163	-4.724	***	
Percent Pell Enrollment	Continuous	0.102	0.036	0.120	2.829	***	
Percent of Student Enrolled in Distance Education	Continuous	0.046	0.025	0.059	1.860	*	
Resources & Expenditures							0.382
Percent Part-Time Faculty	Continuous	0.016	0.020	0.023	0.818		
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	0.568	0.308	0.063	1.841	*	
Revenue from State Appropriations	Continuous, Adjusted for Inflation	-0.104	0.197	-0.019	-0.531		
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.960	0.263	0.132	3.645	***	
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-1.184	0.613	-0.065	-1.931	*	
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	1.393	0.560	0.082	2.488	**	
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.580	0.437	0.045	1.327		

Note. *p<0.10; **p<0.05; ***p<0.01

in many cases, there is little or no difference in the two versions of the coefficients, which is to be expected in cases of small coefficients.

General characteristics. General characteristics of community colleges were the first to be included in the statistical model. Alone, holding the degree of urbanization, institutional size, institutional type, and multi-institutional control constant accounted for 19.8% of the variance in the award rates for all entering students. For first-time students, 18% of variance was explained. For not-first-time students, general characteristics accounted for 19.6% of the variation in award rates. Of the general characteristics, only institutional size did not significantly predict any of the three dependent variables. For all three variations of community college award rates, the degree of urbanization and institutional type were significant predictors. For all entering students ($p<0.05$) and for first-time students ($p<0.01$), multi-institution control also exhibited statistical significance.

The degree of urbanization was sourced as an ordinal variable ranging from 1 to 12, with 1 indicating the most rural and 12 indicating the most urban. To account for changes within a community college's immediate environment (i.e., locales becoming more urban during the observation period), the four-year average degree of urbanization was calculated and included in the statistical models. Broadly, the coefficients indicated this general characteristic of community colleges shared a negative relationship with all three variations of award rates. For all entering students, as the degree of urbanization increased along this scale, the four-year award rates declined by 1%. The change in award rates for first-time students decreased at roughly the same rate as the degree of urbanization increased. For not-first-time students, the unstandardized coefficients for the degree of urbanization, which (as a reminder to the reader) is interpreted as a

one-unit change rather than a percentage change, indicated that the award rate declined 0.29 percentage points as the location became more urban.

Given the ordinality of the degree of urbanization's measurement, however, readers should consider the linear interpretation (i.e., the change in y for a change in x) with some caution. Because the distance between units within the degree of urbanization may not be equidistant (e.g., the difference between the most rural and the second degree of urbanization may not be the same as the distance between the penultimate degree of urbanization and the most urban), the unstandardized coefficient becomes somewhat obscure. Based on the results of separate regressions that used degree of urbanization as a dummy-coded categorical variable instead of ordinal, coefficient values did not substantially differ from those presented herein, and the directionality of all variables, including urbanization (comparing the most urban institutions to the most rural), remained the same,

Institutional type comprised three categories based on Carnegie Classifications: high transfer, high career and technical, and mixed transfer/career. For the regression analyses, institutional type was dummy coded, and high transfer institutions served as the reference group. When compared to the reference group, high career and technical institutions reported award rates for all entering students roughly 32% higher. Mixed transfer/career institutions were approximately 7% higher than high transfer institutions. The unstandardized coefficients for institution type indicated similar results for first-time student award rates. High career and technical institutions had award rates 35.4% higher when compared to high transfer institutions, and mixed transfer/career institutions were 7.6% higher. Unlike with the other two dependent variables, only high career and technical institutions were statistically significant for not-first-time student award rates. Compared to high transfer institutions, high career and technical

institutions' award rates for not-first-time students were 7.14 percentage points higher. For all three dependent variables, the standardized coefficients from the OLS regressions indicated that institutional type had the greatest magnitude of effect on award rates.

Multi-institution control, a dichotomous variable indicating whether the institution was part of a multi-institution organization, indicated statistical significance for all entering and first-time student award rates. Community colleges that reported being part of a multi-institution organization had award rates for all entering students just over 6% higher than institutions that did not. For first-time students, these colleges had award rates nearly 13% higher.

Student enrollment characteristics. Introducing student enrollment characteristics to the statistical models increased the proportion of explainable variation to 35.8% for all entering student award rates, and to 34.7% for both first-time and not-first-time student award rates. Pertaining to the demographic attributes of students enrolled at an institution, all independent variables entered into this block were expressed as percentages. Only the characteristics representing part-time enrollment, race, gender, and non-degree-seeking enrollment demonstrated statistical significance for all three dependent variables.

In all three regressions, the relationship between award rates and part-time enrollment, race, and gender was negative. Also of note, all entering and first-time student award rates shared a nearly identical slope for these three characteristics. For every percentage-point increase in part-time enrollment at community colleges, award rates declined by roughly 1% for both all entering and first-time students, and the award rates for not-first-time students declined by 0.18 percentage points. As the proportion of Black, Hispanic, and Native American students increased, the award rates for all entering and first-time students fell by 0.5%, and the award rates for not-first-time students decreased by 0.10 percentage points. Increasing the percentages

of female student enrollment reduced the award rates for all entering and first-time students by 1%. Award rates for not-first-time students declined by 0.32 percentage points for every 1 percentage-point increase in female student enrollment.

Unlike with part-time enrollment, race, and gender, the proportion of non-degree-seeking students demonstrated a positive relationship with award rates. A single percentage-point increase corresponded to a 0.5% and 0.3% increase in all entering and first-time student award rates, respectively. For not-first-time students, award rates rose by 0.18 percentage points.

Two other student enrollment characteristics demonstrated statistical significance for first-time student award rates: the percent of adult student enrollment and the percent of Pell Grant recipients. When adult student enrollment increased by one percentage point, first-time student award rates declined by 0.4%. Likewise, as the percent of Pell Grant recipients increased, so did award rates fall by 0.3%.

Contrary to the observation for first-time student award rates, those of not-first-time students shared a positive relationship with the proportion of Pell Grant recipients. As Pell Grant enrollment grew, award rates increased by 0.10 percentage points. The award rates for not-first-time students, too, were the only of the three dependent variables to share a significant relationship with the proportion of distance learning students. As the percent of students at community colleges taking at least one distance learning course increased by a percentage point, award rates rose by nearly 0.05 percentage points.

Institutional resources & expenditures. The introduction of institutional resources and expenditures variables increased the explainable variance to 37.7% for all entering, to 36.8% for first-time, and to 38.2% for not-first-time students. Apart from the proportion of part-time faculty, the independent variables included in this block of the regression equations represented

sources of revenue and areas of expense. All financial variables included in this block were scaled to values of $1,000 and adjusted for inflation using the Higher Education Pricing Index (HEPI).

Of all the institutional resources and expenditures variables, only the revenue received from tuition and fees demonstrated statistical significance for all three dependent variables in the OLS regressions. For all entering and first-time student award rates, the relationship with tuition and fee revenue was negative. A $1,000 increase in tuition revenue corresponded with a 3% decline in all entering student award rates and a 5% decline in first-time student award rates. This relationship, however, reversed for not-first-time student award rates. A $1,000 increase in tuition revenue increased the award rates of not-first-time student award rates by 0.56 percentage points.

Also, for all entering student award rates, instructional service and institutional services expenditures exhibited statistical significance. For every $1,000 expended per full-time equivalent (FTE) student in instructional services, award rates increased by 2.5%. Similarly, a $1,000 increase in institutional services expenditures per FTE increased award rates for all entering students by 3.5%.

Institutional services per FTE also exhibited a significant and positive relationship with the award rates for first-time students. Increasing expenditures in this core function corresponded with an increase of nearly 5% in first-time student award rates.

Along with tuition revenue, the award rates for not-first-time students also shared significant relationships with instructional services, academic services, and student services expenditures per FTE. Of these, instructional and student services expenditures shared a positive relationship with award rates, whereas the relationship with academic service expenditures was

negative. A $1,000 increase in instructional and student services expenditures per FTE raised award rates for not-first-time students by 1 and 1.4 percentage points, respectively. Conversely, a $1,000 increase to academic service expenditures per FTE prompted award rates to lower by roughly 1.2 percentage points.

How do community college award rates vary across states?

Answering the second research question relied on multilevel modeling techniques. Of course, descriptive statistics yield some insight into how community colleges vary across states. As referenced in Chapter II, Table 6.1 in Appendix A illustrated the average award rate for each state. A revised copy of this table, based on the sample data after multivariate outliers were removed, is available in Appendix B. The multilevel modeling techniques provided for a more detailed insight into the variation across states. These involved the calculation of intraclass correlation coefficients (ICC) and design effects (DE) for each of the three dependent variables. Together, these statistics illustrate the degree to which the independence of errors statistical assumption is violated if the grouping structure (i.e., states, for purposes of this study) is ignored.

As described in Chapter III, building a multilevel model is done systematically. The first stage of multilevel design is to estimate the unconditional model, which considers only the dependent variable (i.e., community college award rates) and grouping structure (i.e., the states in which the community colleges are located). The results of the conditional model are presented in Table 4.4 below.

The ICC (ρ) represents the proportion of variance in the dependent variable explained solely by the grouping structure. Thirty-nine percent of the variation in award rates for all entering, thirty-seven percent for first-time, and forty-two percent for not-first-time student award rates was explained by differences between states. According to Peugh (2010), ρ values in

Table 4.4. Results of Unconditional Model by Dependent Variable

Award Rate Variable	Intercept	σ^2_w	σ^2_b	ρ	DE
All Entering Student	3.06	0.12	0.08	0.39	7.35
First-Time Entering Students	2.94	0.14	0.08	0.37	7.02
Not-First-Time Entering Students	27.73	90.13	65.74	0.42	7.84

the social sciences typically range between 0.05 and 0.20. In all three cases presented here, the ρ values far exceed Peugh's threshold.

Using the ρ values and the average number of community colleges per state, the DE statistics were calculated. If data are nested (i.e., grouped or clustered), the standard error will be negatively biased. The DE may be interpreted as a multiplier that would have to be applied to the standard error in order to correct for this bias. According to Peugh (2010), DE values greater than 2.0 justify the need for and use of multilevel modeling techniques. Just as with the ρ values, the DE values calculated as a part of this study far exceed the thresholds established in prior research.

Which institutional characteristics significantly influence community college award rates after accounting for state-level characteristics?

The first step in building a multilevel model, estimating the unconditional model, provided information to address the second research question. To address the third research question, the level-one (institutional characteristics) and level-two (state characteristics) blocks were introduced to the equation. These subsequent steps in constructing the multilevel models yielded insight into how the relationship between institutional characteristics and award rates changes once differences between states and the economic conditions within those states are acknowledged.

Level-one leveraged the same independent variables used in the OLS regressions. Before being entered into the regression equation, however, the independent variables were centered on the grand mean. Level-two included two variables, each state's four-year average unemployment rate and the average four-year median household income. These variables, too, were centered on the grand mean. Also, as with the OLS regressions, the award rates for all entering and first-time

Table 4.5. Multilevel Model Result for All Entering Student Award Rates

Variable	Label	b	Exp(b)-1	Std. Error	β	*t*	Sig
Intercept		2.282		0.185		12.334	***
General Characteristics							
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.011	-0.011	0.004	-0.088	-2.476	**
Institution Size	Student Enrollment >=5,000 Students	0.006	0.006	0.031	0.008	0.206	
Institution Type	High Career & Technical College	0.260	0.297	0.036	0.268	7.280	***
	Mixed Career & Technical / Transfer College	0.071	0.073	0.028	0.080	2.556	**
Multi-Institution Control	Part of a Multi-Institutional Organization	0.001	0.001	0.031	0.001	0.036	
Student Enrollment Characteristics							
Percent Part-Time Enrollment	Continuous	-0.011	-0.011	0.001	-0.320	-7.446	***
Percent Adult Student Enrollment	Continuous	-0.001	-0.001	0.001	-0.030	-0.888	
Percent Non-Degree Seeking Enrollment	Continuous	0.008	0.008	0.001	0.225	6.248	***
Percent Black, Hispanic, Native American	Continuous	-0.004	-0.004	0.001	-0.219	-5.747	***
Percent Female Enrollment	Continuous	-0.006	-0.006	0.002	-0.085	-2.625	***
Percent Pell Enrollment	Continuous	0.003	0.003	0.001	0.096	2.124	**
Percent of Student Enrolled in Distance Education	Continuous	0.002	0.002	0.001	0.071	2.156	**
Resources & Expenditures							
Percent Part-Time Faculty	Continuous	2.65E-04	2.65E-04	0.001	0.010	0.415	
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	-0.001	-0.001	0.001	-0.004	-0.913	
Revenue from State Appropriations	Continuous, Adjusted for Inflation	0.001	0.001	0.008	0.004	0.094	
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.002	0.002	0.001	0.009	2.500	**
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.001	-0.001	0.002	-0.002	-0.657	
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.003	-0.003	0.002	-0.005	-1.417	
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.003	0.003	0.002	0.006	1.710	*
State Characteristics							
Average Unemployment Rate	Continuous	0.001	0.001	0.020	0.004	0.065	
Average Median Household Income	Continuous	0.009	0.009	0.003	0.018	2.824	***

Note. *p<0.10; **p<0.05; ***p<0.01

Table 4.6. Multilevel Model Result for First-Time Student Award Rates

Variable	Label	b	Exp(b)-1	Std. Error	β	*t*	Sig
Intercept		2.258		0.215		10.495	***
General Characteristics							
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.008	-0.008	0.005	-0.062	-1.754	*
Institution Size	Student Enrollment >=5,000 Students	0.002	0.002	0.033	0.002	0.062	
Institution Type	High Career & Technical College	0.258	0.295	0.038	0.252	6.882	***
	Mixed Career & Technical / Transfer College	0.084	0.087	0.029	0.090	2.895	***
Multi-Institution Control	Part of a Multi-Institutional Organization	0.034	0.035	0.033	0.037	1.022	
Student Enrollment Characteristics							
Percent Part-Time Enrollment	Continuous	-0.013	-0.013	0.002	-0.348	-8.078	***
Percent Adult Student Enrollment	Continuous	-0.004	-0.004	0.001	-0.103	-3.056	***
Percent Non-Degree Seeking Enrollment	Continuous	0.006	0.006	0.001	0.176	4.920	***
Percent Black, Hispanic, Native American	Continuous	-0.005	-0.005	0.001	-0.248	-6.510	***
Percent Female Enrollment	Continuous	-0.006	-0.006	0.002	-0.077	-2.400	**
Percent Pell Enrollment	Continuous	9.19E-05	9.19E-05	0.001	0.003	0.063	
Percent of Student Enrolled in Distance Education	Continuous	0.001	0.001	0.001	0.034	1.051	
Resources & Expenditures							
Percent Part-Time Faculty	Continuous	-1.68E-04	-1.68E-04	0.001	-0.006	-0.252	
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	-0.002	-0.002	0.001	-0.007	-1.586	
Revenue from State Appropriations	Continuous, Adjusted for Inflation	0.009	0.009	0.009	0.041	1.019	
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.002	0.002	0.001	0.006	1.593	
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.002	-0.002	0.002	-0.003	-0.948	
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.003	-0.003	0.002	-0.005	-1.361	
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.003	0.003	0.002	0.005	1.641	
State Characteristics							
Average Unemployment Rate	Continuous	0.011	0.011	0.023	0.036	0.499	
Average Median Household Income	Continuous	0.008	0.008	3.76E-03	0.016	2.249	**

Note. *p<0.10; **p<0.05; ***p<0.01

Table 4.7. Multilevel Model Result for Not-First-Time Student Award Rates

Variable	Label	b	Std. Error	β	*t*	Sig
Intercept		7.554	4.805		1.572	
General Characteristics						
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.400	0.128	-0.116	-3.137	***
Institution Size	Student Enrollment >=5,000 Students	0.408	0.892	0.017	0.457	
Institution Type	High Career & Technical College	6.787	1.012	0.253	6.706	***
	Mixed Career & Technical / Transfer College	1.211	0.786	0.050	1.541	
Multi-Institution Control	Part of a Multi-Institutional Organization	0.378	0.874	0.016	0.432	
Student Enrollment Characteristics						
Percent Part-Time Enrollment	Continuous	-0.204	0.042	-0.212	-4.834	***
Percent Adult Student Enrollment	Continuous	0.038	0.037	0.036	1.032	
Percent Non-Degree Seeking Enrollment	Continuous	0.212	0.034	0.230	6.200	***
Percent Black, Hispanic, Native American	Continuous	-0.082	0.022	-0.147	-3.777	***
Percent Female Enrollment	Continuous	-0.226	0.066	-0.115	-3.449	***
Percent Pell Enrollment	Continuous	0.180	0.039	0.213	4.573	***
Percent of Student Enrolled in Distance Education	Continuous	0.044	0.026	0.057	1.693	*
Resources & Expenditures						
Percent Part-Time Faculty	Continuous	0.007	0.018	0.010	0.383	
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	0.076	0.038	0.008	1.996	**
Revenue from State Appropriations	Continuous, Adjusted for Inflation	-0.245	0.224	-0.044	-1.094	
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.076	0.028	0.010	2.733	***
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.109	0.061	-0.006	-1.792	*
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.019	0.059	0.001	0.329	
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.075	0.044	0.006	1.719	*
State Characteristics						
Average Unemployment Rate	Continuous	-1.176	0.512	-0.142	-2.295	**
Average Median Household Income	Continuous	0.155	0.083	0.011	1.852	*

Note. *p<0.10; **p<0.05; ***p<0.01

students required transformation due to violations of statistical assumptions. Tables 4.5, 4.6, and 4.7 below present the results of the final multilevel model for each dependent variable.

The significant intercept value for each of the dependent variables is an indicator that, even accounting for the variables comprising the conceptual framework, there remains significant variation in the award rates for community colleges.

To assess for model fit, deviance statistics were compared between models. In general, a smaller deviance statistic indicates a better model fit. As a point of reference, if the model fit the data perfectly, the deviance statistic would be zero (Heck et al., 2014). Because deviance statistics follow a chi-square distribution (Heck et al., 2014), the difference between deviance statistics were tested for statistical significance. For all three dependent variables, the inclusion of the level-one independent variables significantly reduced the deviance statistic at the $p<0.001$ level. Adding the level-two independent variables significantly reduced the deviance statistic for the award rates for all entering students and not-first-time students at the $p<0.05$ level. The difference in deviance statistic for first-time students was not statistically significant ($p=0.101$) but was on the threshold of being considered as such. The deviance statistics and results of the chi-square tests may be found in Table 6.5 in Appendix G.

General characteristics. After differences between states were taken into account, a community college's degree of urbanization and institutional type demonstrated a significant relationship with the award rates for all entering, first-time, and not-first-time students. For all three dependent variables, the relationship to an institution's degree of urbanization was negative. As an institution's location became more urban, the award rates for all and first-time students decreased by roughly 1%. For not-first-time students, award rates declined by 0.4 percentage points for every one-unit increase in urbanicity.

Regarding institutional type, high career and technical institutions reported award rates for all entering students by nearly 30% higher than high transfer colleges. Mixed transfer/career institutions reported award rates 7% higher than high transfer institutions. Institutional type (specifically referring to high career and technical institutions) had the second largest effect on award rates for all entering student award rates; this is the same for first-time student award rates. High career and technical institutions were nearly 30 percent higher than high transfer institutions in award rates for first-time students. In contrast, mixed transfer/career institutions were nearly 9% higher. High career and technical institutions were 6.8 percentage points higher than high transfer institutions in not-first-time student award rates. Institutional type demonstrated the greatest effect, based on the standardized coefficients, on the award rates for not-first-time students

Student enrollment characteristics. The results of the multilevel model revealed a significant relationship between four student enrollment characteristics with all three of the dependent variables: the percent of part-time student enrollment, non-degree-seeking student enrollment, race, and gender. Of these, the relationships with part-time enrollment, race, and gender were negative.

For every percentage-point increase in part-time student enrollment, the award rates for all entering and first-time students declined by roughly 1%. For not-first-time students, award rates declined by 1.3 percentage points. The standardized coefficients for the proportion of part-time student enrollment indicated the greatest influence on the award rates for all entering and first-time students.

Regarding race, award rates for both all entering and first-time students declined by approximately one-half percent for every percentage point increase in enrollment of Black,

Hispanic, and Native American students. The award rates for not-first-time students fell by less than a tenth of one percentage point.

As the proportion of female student enrollment increased, award rates for both all and first-time students declined by 0.6%, and the award rates for not-first-time students diminished by 0.23 percentage points.

The percent of non-degree-seeking student enrollment positively related to the award rates for all entering, first-time, and not-first-time students. As this proportion of students increased by one percentage point, award rates rose by 0.8% and 0.6% for all entering and first-time students, respectively. For not-first-time students, award rates increased by over 0.2 percentage points as the enrollment of non-degree-seeking students increased.

For all entering and not-first-time students, statistical significance was observed with two other student enrollment characteristics, the proportion of Pell Grant recipients and of distance education enrollment. As the proportion of Pell Grant recipients rose, the award rates increased by 0.3% for all entering students and by 0.18 percentage points for not-first-time students. The proportion of distance education students, which also demonstrated a positive relationship, prompted the award rates to rise by 0.2% for all entering students and by roughly 0.04 percentage points for not-first-time students.

The award rates for first-time students demonstrated a significant relationship with only one other student enrollment characteristic, adult student enrollment. As the percent of students over the age of 24 occupied a greater proportion of an institution’s enrollment, the award rates for first-time students declined by 0.4%.

Institutional resources & expenditures. Of the institutional resources and expenditures variables included in the multilevel model, none exhibited a statistically significant relationship with the award rates for first-time students. The award rates for all entering students, however, were significantly related with instructional and institutional expenditures per FTE student. As instructional expenditures per FTE increased by $1,000, award rates for all entering students also increased by 0.2%. When institutional expenditures increased by the same rate, the award rates rose by 0.3%.

Not-first-time student award rates were significantly and positively related with tuition and fee revenue, instructional expenditures, and institutional expenditures. As an institution's revenue from tuition and fees increased by $1,000, the award rates for not-first-time students increased by 0.08 percentage points. For each $1,000 increment in instructional and institutional expenditures per FTE, award rates increased by roughly 0.08 percentage points. This dependent variable, too, was the only one to share a significant relationship, albeit a negative one, with academic services per FTE. As expenditures in this core function increased by $1,000, award rates for not-first-time students fell by 0.11 percentage points.

State Characteristics

Along with accounting for differences between states, the multilevel model also included two state-level characteristics to reflect the average economic conditions within the states during the four-year observation period: unemployment rates and median household income. In addressing the research question, less emphasis was placed on the interpretation of these variables. Of the three dependent variables, only the award rates for not-first-time students shared a significant relationship with both state characteristics. Moreover, the award rates for not-first-time students was the only dependent variable to be significantly related with a state's

unemployment rates. As unemployment rates climbed within states, the average award rate for not-first-time students fell by 1.18 percentage points.

Median household income was positively related with all three dependent variables. As this state metric increased by $1,000, the average award rate for all entering students increased by 0.9%, and the award rate for first-time students increased by slightly less (0.8%). For not-first-time student award rates, median household income prompted an increase by 0.16 percentage points.

Summary

This chapter presented the results of the methodological procedures outlined in Chapter III. OLS regression and multilevel modeling techniques were employed to study three variations of community college award rates. Results of the primary statistical analyses were displayed within the chapter. Any results pertaining to data cleaning, preparation, or other preliminary analyses are contained in this study's appendices. The regression analyses revealed variation in the institutional characteristics' relation with award rates once differences between states were taken into account. Too, the significant predictors varied between the three different types of community college award rates. In general, the independent variables related to the degree of urbanization, institutional type, part-time enrollment, non-degree-seeking student enrollment, racial minority student enrollment, and female student enrollment exhibited constant significance and directionality across the three dependent variables and across the statistical models.

In the next, and final, chapter of this dissertation study, the results presented here will be interpreted and discussed in relation to the current context presented in Chapter I and to the scholarly literature presented in Chapter II. Conclusions, implications, and recommendations based on these results, moreover, will be outlined in Chapter V.

CHAPTER V

DISCUSSION AND CONCLUSION

This dissertation study sought to provide insight into the relationship between institutional characteristics of community colleges and their outcomes and to fill a critical gap in the scholarly literature. By incorporating additional data salient to community colleges into the conceptual framework, by assessing award rates rather than the traditional three-year (150%) graduation rates, and by employing a combination of statistical methods, this study provided a clearer picture of what institutional characteristics predict institutional outcomes and of the importance to account for differences between states when analyzing data on a national scale. More specifically, three research questions guided this study:

1) Which institutional characteristics significantly influence community college award rates?
2) How do community college award rates vary across states?
3) Which institutional characteristics significantly influence community college award rates after accounting for state-level characteristics?

Addressing these research questions involved ordinary least squares (OLS) and multilevel modeling regression techniques. In place of the 150% graduation rate, which is representative of a specific subgroup of first-time students, this study used three variations of community college award rates, or the proportion of entering students earning a postsecondary credential within a four-year period. These data have only recently been included in the Integrated Postsecondary Education Data System (IPEDS) and permit researchers to distinguish between all entering, first-time, and not-first-time students. All three variations of award rates were regressed onto

independent variables representing general institutional characteristics, student enrollment characteristics, and characteristics of institutional resources and expenditures.

The purpose of this chapter is to provide further discussion into the results presented in the previous chapter and to proffer the relevant implications to and recommendations for policy and future research. Each of the research questions outlined above will be discussed individually. Following a more thorough interpretation of the results in the social and scholarly context, the implications and recommendations will be discussed in aggregate.

Interpretation of Results by Research Question

Which institutional characteristics significantly influence community college award rates?

Regressing community college award rates onto the general institutional characteristics revealed that the degree of urbanization, institutional type, and multi-institution control were significant predictors. While the effect of being a part of a multi-institution organization had not (to the researcher's knowledge) been investigated previously, the results pertaining to the degree of urbanization and to institutional type echoed past findings from the scholarly literature. Institutions from more urban environments have historically been associated with lower graduation rates (e.g., Horn et al., 2019), and the same has proved true of award rates not limited to students classified as first-time, full-time. As mentioned in the preceding chapter, however, the reader should consider the linear interpretation for the degree of urbanization with some caution.

As supported in previous literature (e.g., Kamer & Ishitani, 2020), community colleges of different types or curricular emphases demonstrated significant differences in their award rates. Using high transfer community colleges as the reference group, the OLS regressions for all three dependent variables revealed that high career and technical institutions had substantially greater

award rates. Mixed transfer/career institutions, likewise, exhibited greater award rates, although to a lesser degree. After accounting for all independent variables in the statistical models, institutional type (especially pertaining to high career and technical institutions) emerged as having the greatest magnitude of effect for award rates. These results underscore the importance of distinguishing between different classifications of community colleges in studies of institutional outcomes. As prefaced in Chapter I, community colleges evolved distinctly from four-year institutions over the past century and developed diverging institutional missions. If researchers ignore this aspect of community college and treat them as a homogenous group, their results would undoubtedly be both misleading and ambiguous.

The inclusion of an indicator of whether an institution belonged to a multi-institution organization was not directly linked to past literature, but it provided a connection to the Resource Dependency Theory (RDT) bolstering this study. RDT claims that organizations are inseparable from their immediate surroundings (e.g., the sources of their resources). In the case of publicly supported organizations, such as community colleges, the availability of their resources may be much more stable, but these institutions are subject to additional limitations and regulations. Incorporating a multi-institution control, therefore, provided a proxy in the statistical analyses to represent a limitation to some community colleges' autonomy. The results, however, indicated that institutions belonging to multi-institution organizations reported higher award rates than those who did not. These results suggest that multi-institution organizations may provide elements of support to their institutions along with subjecting them to additional regulation.

Of special note pertaining to the general characteristics of community colleges, institutional size did not demonstrate statistical significance for any of the three dependent

variables. This, too, was observed with the multilevel regression results, which will be discussed later in this chapter. This lack of statistical significance contradicts prior research. Of all institutional characteristics assessed in relation to community college academic outcomes, institutional size is consistently identified as a predictor (e.g., Urias & Wood, 2014). The results of this study do not support such a claim.

For student enrollment characteristics, part-time student enrollment, race, gender, and non-degree-seeking student enrollment proved to be significant predictors of all three forms of award rates. Pell Grant recipient enrollment had opposite effects for first-time and not-first-time students. Also, adult student enrollment shared a negative relationship with first-time student award rates. The proportion of distance education enrollment, too, positively predicted not-first-time student award rates.

The results related to part-time enrollment and race are consistent with those reported within the literature (e.g., Calcagno et al., 2008; Yu, 2017). One may easily find it intuitive that as the proportion of part-time enrollees increases, institutional outcomes decrease. After all, students enrolled on a part-time basis will take longer to complete program requirements as opposed to students enrolled in full-time hours. Past research supported the hypothesis that part-time enrollment would significantly and negatively predict graduation rates (e.g., Calcagno et al., 2008). Not only did this prove true from the results of the current study, the proportion of part-time enrollment emerged among the strongest predictors, per the standardized coefficients, of outcomes. More importantly, part-time enrollment is a defining characteristic of community colleges, where many students may be incapable of or have numerous barriers preventing them from enrolling on a full-time basis. The significance and directionality of this variable is wholeheartedly expected.

Similarly, as the proportion of racial minority students increased within enrollment, so did the institution's academic outcomes decrease. This conjecture has been consistently observed within past research (e.g., Yu, 2017). These findings demonstrate a failing of community colleges to support and help progress all students successfully to completion.

Findings related to gender run contrary to what one may have supposed from the literature. Given that prior research has shown that women are more likely than men to persist and to complete credentials (e.g., Patel & Jepsen, 2018), one may have assumed that the relationship between the proportion of female students and award rates would have been positive. Even so, as mentioned in Chapter II, the connection between gender and outcomes has not consistently demonstrated statistical significance in past research. Moreover, the award data leveraged for this study are indicative of the 2010-2011 cohort of entering community college students. Further research is required to verify if these results remain true across multiple cohorts.

As the proportion of non-degree-seeking students increased, so did award rates increase across all three statistical models. These results are rather unexpected. One might assume that as non-degree-seeking student enrollment increases, the academic outcomes of degree-seeking students might falter. Unfortunately, prior literature in this area provided no benchmark to assess the validity of the results pertaining to this variable. One may speculate that non-degree-seeking students, who may be experienced professionals or those taking coursework for personal development, contribute to a positive and meaningful learning environment. Like part-time student enrollment, however, the proportion of non-degree-seeking students is a vital part of community colleges' institutional identities. These institutions are extensions of their surrounding communities, and they provide educational and professional development services

beyond academic programs leading to official certifications. Moreover, in relation to the Human Capital Theory perspective of this study, working professionals taking coursework under non-degree-seeking status are still investing into their knowledge, capability, and skill even if their study is not accrued toward an academic credential.

Past research has identified the negative relationship between adult student enrollment and community college graduation rates (e.g., Kamer & Ishitani, 2020). The results for the current study provide continued support for this perspective, at least in relation to the academic outcomes of all entering and first-time students. Of particular interest, the proportion of adult student enrollment was neither negatively nor significantly related to the award rates for not-first-time students. This may be because the students classified as not-first-time may have also been considered adult students (e.g., over 24 years old). As the proportion of their age-group peers increased, so did their award rates.

Regarding Pell Grant recipients, the positive directionality of the relationship with award rates is supported by the literature (e.g., Park & Scott-Clayton, 2018), but the negative findings observed with first-time student award rates run contrary. As with the results for gender, this observation may be an isolated attribute of the 2010-2011 cohort. To test this speculation, additional time, data, and research are needed. Even so, one may consider Pell Grant receipt as an indication of assistance to financially needy students, who may require additional resources to promote their success and may experience myriad situational barriers to that success.

Distance education enrollment is somewhat supported within the literature. The general assumption is that the relationship would be negative. Research by Shea and Bidjerano (2014), however, indicated that this may not be the case when looking at community colleges on a national scale. This research seems to support that conjecture. Given the ongoing coronavirus

pandemic at the time of this study, community colleges (as well as other types of postsecondary institutions) may increasingly leverage the use of distance learning coursework in the promotion of social distancing and public health safety. The potential for an increase in the proportion of distance learning enrollment, which has already risen considerably at community colleges in recent years, adds pressure and importance to continued research in understanding why there is not greater consistency in how distance education relates to academic outcomes.

For institutional resources and expenditures, only tuition and fee revenue were significantly related to all three dependent variables, although the direction of the relationship differed for not-first-time student award rates. All four forms of institutional services expenditures per FTE demonstrated some degree of statistical significance, though not consistently across the three dependent variables.

Of the core expenditures categories, only the negative relationship between academic services expenditures and outcomes at community colleges is supported by the literature (e.g., Calcagno et al., 2008). While the other forms of institutional expenditures have not been observed as significant predictors of community college outcomes in past studies, the directionality of the relationship observed within the current study echoes that of previous studies.

Of particular note, the proportion of part-time faculty did not demonstrate statistical significance, as would have been expected based on the literature. As with many other characteristics incorporated into the statistical models for this study, the proportion of part-time faculty is a distinguishing attribute of community colleges. Just as their student enrollment may depend upon local resources, so too may the supply of faculty and course instructors. Previous studies (e.g., Jacoby, 2006) found the reliance on part-time faculty, which may be sourced from

local industries and resources, was a negative predictor of graduation rates. The use of award rates (which permitted the current research to go beyond the typical first-time, full-time cohort of students) as the academic outcome measure, however, negates such observations. Apart from assessing the academic outcome based on a different denominator of students, another explanation of the difference between these results and those of past research could be with how the concept of part-time faculty is defined. For this study, the field was derived from a calculation of part-time instructional faculty over the sum of all instructional faculty. Other studies, unless explicitly stated, may have leveraged different definitions.

How do community college award rates vary across states?

Querying descriptive statistics of community college award rates is a fast and efficient means of observing variation across states (see Table 6.1 in Appendix A and Table 6.2 in Appendix B). The methods employed to address this question, however, yielded deeper insight into the importance of accounting for differences between states when studying institutional outcomes on a national scale. From the unconditional model of the multilevel regressions estimated for the three dependent variables, the intraclass correlation coefficients (ICC) indicated that 39%, 37%, and 42% of the variation in award rates for all entering, first-time, and not-first-time students, respectively, were due to differences between states. To contextualize the magnitude of these results, studies in the social sciences merit justification for multilevel modeling for ICCs of at least 0.05 (or 5% variation; Peugh, 2010).

These findings demonstrate both a statistical and contextual element of this study. The statistical assumption of the independence of errors is one often violated to some degree in social science research. Community colleges within the same state are subject to similar rules, regulations, labor markets, and political contexts. In other words, they may be more akin to one

another than to their out-of-state equivalents. Their error terms, therefore, would not necessarily be independent of each other. Ignoring the grouping structure runs the risk of creating a Type I error, or inflated statistical significance precipitated from deflated standard errors. To model how much consequence ignoring the grouping structure would have on the standard errors, the design effects were calculated. These statistics are an extension of the ICC, and they may be interpreted as a multiplier that would have to be applied to the standard error. DEs of 7.35 for all entering, 7.02 for first-time, and 7.84 for not-first-time students indicated how severely important it is to account for the grouping structure. As a general benchmark, DEs of at least 2 are considered evidence of statistical assumption violation and evidence to support multilevel modeling (Peugh, 2010).

Which institutional characteristics significantly influence community college award rates after accounting for state-level characteristics?

The third research question was an extension of the previous two. The question shared the same intent as the first research question with the intent to unpack the statistically significant relationships between community college award rates and institutional characteristics. To do this, the principles from the second research question prompted the inclusion of a means to account for differences between states and to incorporate characteristics of those states.

The same general characteristics that significantly predicted award rates in the OLS regressions remained significant in the multilevel model. The exception to this is the multi-institutional control variable, which no longer demonstrated statistical significance. A possible explanation for this is that within the OLS regression models, the multi-institutional control variable was acting as a proxy for the grouping structure. With differences between states being taken into account with the multilevel model, the significance of this variable waned.

For student enrollment characteristics, part-time enrollment, race, gender, and non-degree-seeking student enrollment, and adult student enrollment remained statistically significant predictors. Moreover, the directionality of the relationship between these characteristics and award rates remained unchanged with the incorporation of the grouping structure and the inclusion of state-level economic characteristics.

Pell Grant recipient enrollment and the proportion of distance education students, however, exhibited some changes compared to the OLS models. Though its magnitude was miniscule, the proportion of Pell Grant recipients no longer acted as a negative nor as a significant predictor of first-time student award rates once differences between states and characteristics of state economic factors were held constant. This variable did, however, demonstrate a positive and significant relationship with all entering student award rates, which was not observed in the OLS models.

While the proportion of distance education students still significantly and positively predicted the award rates for not-first-time students, the multilevel model results indicated that the same is true for all entering students.

Leveraging the multilevel model and incorporating characteristics of state economic conditions had a noticeable effect on the relationships between first-time student award rates and the independent variables in the institutional resources and expenditures block. The multilevel model results did not indicate any statistically significant relationships in this regard. Readers should note, however, that statistical significance is not synonymous with practical significance. Undoubtedly, investing resources into all aspects of a student's experience may influence academic outcomes to some degree.

Then multilevel models also indicated that tuition and fee revenue only significantly predicted not-first-time student award rates. Academic services expenditures per FTE remained a negative and significant predictor of not-first-time award rates. Institutional services expenditures per FTE positively predicted both all entering and not-first-time student award rates. Student service expenditures, however, no longer significantly predicted not-first-time student award rates within the multilevel model.

Tables 5.1, 5.2, and 5.3 below provide a comparison of the significant institutional characteristics predictors of award rates between the OLS and multilevel regression models. The characteristics are divided by directionality (positively or negatively influencing) and ranked according to the size of the standardized coefficients. As the reader will observe, there is variation in the order of variables between models, but the institutional characteristics with the greatest magnitude of influence on award rates remain somewhat consistent.

State economic characteristics, unemployment rates and median household incomes, were included at the second level of the multilevel models but were of lesser interest in the analyses as compared to the institutional characteristics. The rationale for their inclusion owed to the fact that the national economy was recovering from a recession during the observation period. Even though they garner less focus in this study, the economic characteristics related to the three variations of award rates differently. To all entering and first-time students award rates, only the median household income demonstrated statistical significance. To not-first-time student award rates, both economic characteristics were significant. This observation is not entirely unexpected, given that the population of not-first-time students may include larger

Table 5.1. Ranked Standardized Coefficient Comparison, All Entering Student Award Rates

Direction	OLS		MLM	
Positive	Variable	β	Variable	β
	Institution Type, High Career & Technical College	0.285	Institution Type, High Career & Technical College	0.268
	Percent Non-Degree Seeking Enrollment	0.151	Percent Non-Degree Seeking Enrollment	0.225
	Instructional Service Expenditures per FTE	0.093	Percent Pell Enrollment	0.096
	Institutional Services Expenditures per FTE	0.075	Institution Type, Mixed Career & Technical / Transfer College	0.080
	Institution Type, Mixed Career & Technical / Transfer College	0.073	Percent of Student Enrolled in Distance Education	0.071
	Multi-Institution Control	0.071	Instructional Service Expenditures per FTE	0.009
			Institutional Services Expenditures per FTE	0.006
Negative	Variable	β	Variable	β
	Percent Part-Time Enrollment	-0.269	Percent Part-Time Enrollment	-0.320
	Percent Black, Hispanic, Native American Enrollment	-0.227	Percent Black, Hispanic, Native American Enrollment	-0.219
	Percent Female Enrollment	-0.136	Degree of Urbanization	-0.088
	Revenue from Tuition and Fees	-0.100	Percent Female Enrollment	-0.085
	Degree of Urbanization	-0.078		

Table 5.2. Ranked Standardized Coefficient Comparison, First-Time Student Award Rates

Direction	OLS		MLM	
Positive	Variable	β	Variable	β
	Institution Type, High Career & Technical College	0.295	Institution Type, High Career & Technical College	0.252
	Multi-Institution Control	0.132	Percent Non-Degree Seeking Enrollment	0.176
	Percent Non-Degree Seeking Enrollment	0.093	Institution Type, Mixed Career & Technical / Transfer College	0.090
	Institutional Services Expenditures per FTE	0.092		
	Institution Type, Mixed Career & Technical / Transfer College	0.079		
Negative	Variable	β	Variable	β
	Percent Part-Time Enrollment	-0.279	Percent Part-Time Enrollment	-0.348
	Percent Black, Hispanic, Native American Enrollment	-0.231	Percent Black, Hispanic, Native American Enrollment	-0.248
	Revenue from Tuition and Fees	-0.148	Percent Adult Student Enrollment	-0.103
	Percent Female Enrollment	-0.123	Percent Female Enrollment	-0.077
	Percent Adult Student Enrollment	-0.100	Degree of Urbanization	-0.062
	Percent Pell Enrollment	-0.088		
	Degree of Urbanization	-0.066		

Table 5.3. Ranked Standardized Coefficient Comparison, Not-First-Time Student Award Rates

Direction	OLS		MLM	
Positive	Variable	β	Variable	β
	Institution Type, High Career & Technical College	0.266	Institution Type, High Career & Technical College	0.253
	Percent Non-Degree Seeking Enrollment	0.200	Percent Non-Degree Seeking Enrollment	0.230
	Instructional Service Expenditures per FTE	0.132	Percent Pell Enrollment	0.213
	Percent Pell Enrollment	0.120	Percent of Student Enrolled in Distance Education	0.057
	Student Services Expenditures per FTE	0.082	Revenue from Tuition and Fees	0.008
	Revenue from Tuition and Fees	0.063	Instructional Service Expenditures per FTE	0.010
	Percent of Student Enrolled in Distance Education	0.059	Institutional Services Expenditures per FTE	0.006
Negative	Variable	β	Variable	β
	Percent Part-Time Enrollment	-0.189	Percent Part-Time Enrollment	-0.212
	Percent Black, Hispanic, Native American Enrollment	-0.169	Percent Black, Hispanic, Native American Enrollment	-0.147
	Percent Female Enrollment	-0.163	Degree of Urbanization	-0.116
	Degree of Urbanization	-0.085	Percent Female Enrollment	-0.115
	Academic Services Expenditures per FTE	-0.065	Academic Services Expenditures per FTE	-0.006

proportions of students employed part- or full-time as compared to the first-time student population.

Implications

Implications for Practice

Because of the national perspective of the current research, the results and implications of this research may not be wholly applicable to each community college. This study's implications for practice, therefore, will be made broadly. Campus administrators and stakeholders should look within the current research for potential connections and commonalities with their institution. Most importantly, in regard to implications for practice, this research should act as a call to action for campus administrators to investigate what best supports the academic outcomes of both first-time and not-first-time students. Even so, some characteristics investigated within this study demonstrated consistency in their significance and directionality across all statistical models and dependent variables. Despite differences between states, institutions' degree of urbanization, type, part-time student enrollment, non-degree-seeking student enrollment, racial minority and female student enrollment demonstrated significant influence on award rates. The consistency in these results may help make campus administrators aware of the crucial and common predictors on award rates across their institutional sector.

Regarding the allocation of financial resources, campus administrators may also look to the consistency observed within instructional, academic, and institutional services expenditures per FTE. Across models and dependent variables, instructional and institutional expenditures indicated a positive relationship, and academic expenditures indicated a negative relationship with award rates. Although these expenditure fields did not exhibit constant significance between the three variants of award rates, the directionality should provide some guidance to decision

makers on where funds may best be invested if the end goal is to support student credential completion. Investing into instructional services is a self-evident means of supporting academic outcomes. Investing into institutional services as a means of supporting student outcomes may seem less intuitive. A possible explanation may be that higher institutional services expenditures may represent the employment of highly qualified and skilled campus administration and leadership. As established previously, academic services expenditures have historically been linked to negative outcomes at community colleges (e.g., Calcagno et al., 2008), though the true and exact reasons behind this relationship have yet to be unpacked. Part of this is due to a data limitation in IPEDS preventing researchers from disaggregating institutional expenditures within the core functions.

Implications for Policy

For policy advocates and makers, this study revealed how the institutional characteristics linked with a key academic outcome change once differences between states are taken into consideration. Just as for campus administrators and practitioners, this study demonstrates to the policy-oriented audience that despite the community (from a Resource Dependency Theory perspective, the source of available resources), select general and student enrollment characteristics emerge as consistent predictors of outcomes. As state-based and national organizations continue to advocate for means to support postsecondary attainment in the community college sector (efforts which are grounded in Human Capital Theory), these results can continue to drive conversations on what supports or hinders student completion (i.e., investments of skilled professionals into the local and national workforce).

For states that use some form of outcomes-based funding formula to determine state appropriations to postsecondary institutions, the results of this study may provide insight into

what supports a common metric of institutional performance. Granted, award rates (as defined within IPEDS) are not ubiquitously incorporated into funding formulas (for instance, Tennessee relies on the count of awards per 100 FTE), it is common for an outcome representing credential attainment to be included in such formulas. Even so, the methods presented here aimed to provide an improved and fairer viewpoint into credential attainment at community colleges.

Also for states that employ outcomes- or performance-based funding formulas, consideration should be given to including provisions that support educational equity at community colleges, especially for racial minority students. Though it is certainly beyond the scope of this study to recommend what such provisions should include, the negative and significant relationship between the proportion of racial minority students and award rates was observed consistently across all statistical models presented herein. In a recent systematic synthesis of the literature on performance-based funding implications, Ortagus et al. (2020) noted that performance-based funding may inadvertently widen the gap in credential attainment and educational equity, especially for racial minority and low-income students. States incorporating performance-based funding formulas, therefore, should give consideration on how to support and incentivize the academic success and outcomes of racial minority students.

By extension, this research also emphasizes the need to look beyond graduation rates in the assessment of community college outcomes and performance. Should agencies leverage graduation rates in their determination of recommended state appropriations, the results of this study should encourage the use of award rates instead, or (at minimum) should encourage them to revise the denominator on which graduation rates are based to include students beyond the first-time, full-time freshmen cohort. As evidenced herein, the characteristics that predict

outcomes vary between first-time and not-first-time students, the latter of which may better represent the larger population of students enrolled in community colleges.

The use of award rates in place of graduations, too, carries implications for federal policy. The total four-year award rates for community colleges (see Appendices A and B) are notably lower than the national 150% graduation rates for two-year colleges. As a direct comparison, NCES (2019b) reported the 150% graduation rate for the 2010 cohort of two-year institutions to be 29.4%. NCES (2020b) indicated that the most recent national graduation rate for two-year institutions was 33% (based on the Fall 2015 cohort). As previously established, the award rate measure is, by definition, a fairer and more accurate means of assessing community college credentialing. The fact that the award rates are lower than graduation rates (which are already subject to critique) should underscore the need for federal policy and support, such as the Reverse Transfer Efficiency Act (see Reilly, 2019). Especially for high transfer institutions, which were consistently observed in this study to have the lowest award rates of all types of community colleges, federal policy such as the Reverse Transfer Efficiency Act could help to streamline credentialing for students who transferred from community colleges and completed certificate or associate degree requirements at a different institution. Establishing policies and procedures to support activities such as reverse transfer options (e.g., encouraging communication and collaboration between Title IV-eligible institutions) would automatically make credentialing more efficient and increase award rates.

Lastly, for policy implications, the research presented here has demonstrated both the degree to which differences between states account for variation in community college academic outcomes and the distinctions between what supports the credentialing of first-time and not-first-time students. This is particularly salient on two accounts: the increased political focus on

nontraditionally aged student enrollment and success and the recent economic downturn. The results demonstrated that the institutional characteristics related to not-first-time students—students who may also be classified as adult or nontraditionally aged students—award rates were largely consistent in significance and directionality between the OLS and multilevel model regressions. This indicates that differences between states and the economic characteristics within those states did little to sway how institutional characteristics influenced these award rates. This also implies that policy advocates and makers could devise a national, widespread approach to aiding not-first-time students. Though certainly beyond the focus and ability of the current study, such approaches could relate to credit transferability, competency-based credit policies, or additional financial or social support plans. The award rates for not-first-time community college students, too, were significantly related to both aspects of state economic conditions (unemployment rates and median household income). As the United States enters into a new economic recession, the effects on community college award rates remains unknown at the time of this study, but, from the results presented here, one can easily expect the recession to influence the outcomes of not-first-time students especially.

Implications for Future Research

An immediate implication for future research into this area is to unpack the community college award rates further by expanding the multilevel models established in the current study. This would ideally begin with an assessment of random effects. For the current study, the fixed effects multilevel model assumed that the effect of each institutional characteristic would have been the same across (i.e., have equal slopes for) all community colleges. One could reasonably suspect that the effects of any of these characteristics would have varied across different institutions in different states. As such, a natural extension of this study would be to assess the

degree to which the independent variables vary randomly across the states. This process should begin with a systematic assessment of the random effects for each of the independent variables found to be statistically significant in this study. Future research should also assess for potential within-level (i.e., between institutional characteristics) and cross-level (i.e., between institutional and state characteristics) interactions.

Extending from the idea established in the preceding paragraph, future research should consider how to treat the degree of urbanization, especially with studies considering multiple years of institutional data. As described in Chapters III and IV, the four-year average degree of urbanization was calculated for the statistical models due to institutions reporting different values for this field across the observation period. In other words, the method used in this study acknowledged that the urbanicity of institutions changes over time, just as other institutional characteristics might. Future research should investigate alternative methods of addressing and accounting for characteristics such as urbanicity and should assess the implications of treating those characteristics as fixed and unchanging. Furthermore, future research might consider investigating alternate sources of information on community college environments and determining how they compare to the self-reported data within IPEDS. For example, community- or county-level data on urbanicity may be sourced from the United States Census Bureau to determine how consistent such data are with the data reported directly by institutions.

The positive relationship observed with the proportion of non-degree-seeking students and award rates was a perplexing and unexpected one. Future research should focus on studying the effects of non-degree-seeking enrollment on academic outcomes. Such research could help both practice- and policy-oriented stakeholders understand the implications of serving increasing

proportions of non-degree-seeking students in the context of academic outcomes and could provide a better understanding into the positive results indicated within the current study.

A limitation was provided in the first chapter regarding the absence of a level-two indicator of performance-based funding. Such an indicator would mark whether the state uses a performance- or outcomes-based formula to incentivize institutional performance and to recommend state allocations to postsecondary institutions. This information was not modeled in the current study because no prior research had established a clear benchmark of which states and in which years a performance-based funding formula was in place that specifically considered a graduation rate metric. Since then, however, Larocca and Carr (2020) have provided additional insight into this matter. By means of their study leveraging a difference-in-differences model, the researchers identified the states with a funding formula and the years in which it was in place. The results of their study indicated that only two-year institutions demonstrated a significant increase in graduation rates in the presence of a performance-based funding formula. The researchers speculated that the significance may be related to the higher proportion of part-time instructors and a smaller share of full-time, tenured faculty at community colleges. While the caveat concerning community colleges and graduation rates has been thoroughly discussed within this study, Larocca and Carr's (2020) presented an opportunity to extend the current research on award rates by including an indicator to states that had or adopted a performance-based funding formula during the observation period.

While the current research sought to provide a more comprehensive look into how institutional characteristics relate to the academic outcomes at community colleges, more information should still yet be considered in future studies. Certain characteristics of community colleges remain unaccounted. From the historical development of community colleges

summarized in the introductory chapter, the academic profile of community college entrants began evolving in the 1970s with the increased focus on remedial and developmental education. While one might expect that the proportion of students participating in remedial education (and the degree to which students require remediation) would influence educational outcomes, these data are not available in IPEDS. While the academic profiles of enrollees (e.g., upper and lower quartiles of ACT and SAT scores) are collected via IPEDS surveys and could act as a proxy for students needing remediation, these data are sparsely reported by community colleges owing to their open-admission status.

To underscore the potential importance of modeling remediation in future studies, Boatman and Long (2018) conducted a regression discontinuity design study using a single-state administrative dataset and observed that remediation has a negative impact on students who are on the threshold of requiring remedial coursework, but that the impact on outcomes becomes more positive as the amount of remedial coursework the student needs increases. The researchers' evidence supports the claim that remediation could have both a positive and negative influence on a student's academic outcome depending on the dosage. Because remediation would include additional coursework to that already required of a student's academic program, one could expect that remediation would share a negative relationship with an institution's award rate, but adequate data to study this have yet to become available at a national scale.

Pertinent to both future research and policy considerations is how community colleges are identified for studies on a national or multistate scale. In the absence of a prescribed method to identify community colleges in IPEDS, studies of community colleges in the United States have reported sample sizes with considerable differences. The current study used a combination

of sector, Carnegie Classification, and geographic location to select the sample and included a total of 792 institutions with complete data. For example, in a difference-in-differences study of for-profit institutions' effects on public community college performance metrics, Soliz (2018) reported a sample size of 1,237 institutions (1,213 with complete data). In contrast, Faber and Slantcheva-Durst (2020), in their regression study of community college attributes' effects on student earnings, referenced the count of community colleges in the United States to range (based on their sample data) from 793 in 2005-2006 to 669 in 2014-2015. While such studies claim to include data from all community colleges in the country, the research was unquestionably based on different groups of institutions. Unless the researcher(s) clearly describe how they derived and refined their sample of community colleges from IPEDS, readers are unable to discern how the study may have been biased.

To further the point established in the preceding paragraph, individual states may identify their community colleges by different means than how those institutions could be identified in IPEDS. For instance, Tennessee has 13 community colleges. Querying the public, two-year colleges in Tennessee in IPEDS will return a list of 39 institutions. The evident reason behind this is that the state's technical colleges (which are distinct from the state's community colleges) are reported under the classification of public, two-year colleges. Should researchers ignore this detail when extracting sample data from IPEDS, the resulting dataset would include institutions beyond the community college sector. The results of such research, therefore, would be ambiguous and any recommendations thereof would be misleading. Furthermore, community colleges that offer at least one four-year credential would no longer be considered a two-year institution, which makes them more difficult to identify and to group with two-year institutions. Absent a community college indicator in IPEDS, an independent review of the public institutions

within each state to identify community colleges might be considered in order to render a more accurate listing of all community colleges in the nation. A less time-consuming option may be to leverage the comparison group category within IPEDS to identify community colleges based on the types of institutions they consider to be peers.

In two years' time, this study should be revisited and reconducted. All continuous independent variables were reported as four-year averages, but the dependent variables were representative of a single academic year. The reason for this is because IPEDS only recently began including the outcomes measures in its annual data files. In two years, enough data will be available to produce a four-year average of the dependent variable, which would smooth any potential spikes in the award rates and give a more accurate representation.

Recommendations

In general, two recommendations that pertain to policy, practice, and research come from this research. The first is to look beyond graduation rates, depending on the specific nature of the inquiry, in order to ascertain a fairer, more comprehensive perspective on community college academic outcomes. The current study investigated three variations of award rates, a similar metric to graduation rates that is not restricted to the first-time, full-time freshmen cohort. The three perspectives into award rates revealed that the characteristics that predict the outcomes for first-time students differ from those predicting not-first-time students. The institutional characteristic predicting all entering student award rates appeared to be somewhat muddled but far more akin to those predicting first-time student award rates. None of this, however, could be observed through the reliance on graduation rates. If policy makers and advocates, institutional practitioners, and researchers continue to look to improve academic outcomes in an effort to increase the proportion of individuals equipped with a postsecondary credential, assessing award

rates will provide a more meaningful and accurate perspective from which to base decisions and recommendations for improvement.

The second recommendation, as prefaced in the preceding paragraph, is to leverage the principles established within the context and the results of this study to further the ongoing conversation on community college outcomes. In this, stakeholders should be mindful of both the differences within the community college sector, the differences between the students enrolled in community colleges, and differences between the environments (i.e., the communities, regions, or states) in which the community colleges operate. Researchers should especially recognize the relationship and the importance of considering the differences between states. Because community colleges are so closely tied to their surroundings, considering them as homogenous and isolated from their environments would omit a critical aspect of these institutions, would likely present methodological ramifications, and would assuredly yield spurious results.

Conclusion

This research sought to provide a more thorough investigation into how institutional characteristics predict community college outcomes. The impetus behind this research came from critical gaps in the scholarly literature on community college outcomes at a time when these institutions are of special economic importance and are at the center of national and state policy initiatives. In sum, this study found variation in the institutional characteristics and the magnitude thereof once differences between states are taken into consideration. The predictor variables, too, vary across all entering, first-time, and not-first-time student award rates. In general, however, institutional type, the proportion of part-time student enrollment, the proportion of non-degree-seeking student enrollment, the proportion of underrepresented racial

minority students, and the proportion of female students were consistently found to predict all forms of award rates even when accounting for differences between states and state economic characteristics. Given the novelty of the approach taken with this research, further investigation is needed into community college award rates.

Of important note, the reader should be mindful of an underlying assumption of this research. Due to the ongoing coronavirus pandemic, it is uncertain how or to what degree postsecondary education will be impacted. Although it is too early to assess the impacts of the pandemic on fall semester enrollment at community colleges, recent reports indicate a substantially lower enrollment during the summer term (Palmer, 2020). Assuming the negative effects of the pandemic will extend into and beyond the fall semester, American postsecondary education (not limited to community colleges) may be facing substantial modifications and challenges. Furthermore, the recent economic downturn due to the pandemic (see Cassella, 2020) could mean that the economic conditions that fueled initiatives to increase postsecondary credentialing may, too, have changed. This research, therefore, is grounded in the assumption that once public health and economic concerns become less severe, increasing community college outcomes will be just as important as it was previously.

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APPENDICES

APPENDIX A

Table 6.1. Four-Year Award Rates by State

State	Count of Community Colleges	Four-Year Award Rates		
		All Entering Students	First-Time Students	Not-First-Time Students
Alabama	23	20.0	18.3	23.0
Arizona	19	14.6	12.6	17.2
Arkansas	22	29.5	26.7	32.6
California	99	19.6	18.8	19.6
Colorado	9	30.3	27.4	34.5
Connecticut	12	15.0	13.3	18.2
Florida	1	24.0	21.7	30.5
Georgia	22	28.5	28.7	27.7
Hawaii	6	18.0	16.0	21.4
Idaho	4	22.0	18.4	34.0
Illinois	48	24.4	23.6	25.7
Iowa	16	30.1	27.0	37.4
Kansas	25	35.8	31.8	39.7
Kentucky	16	24.8	23.1	30.3
Louisiana	11	20.2	16.1	24.2
Maine	7	29.1	26.3	36.9
Maryland	16	18.9	16.2	21.7
Massachusetts	16	18.7	16.1	25.8
Michigan	22	18.6	16.0	23.0
Minnesota	29	31.2	27.0	36.7
Mississippi	15	25.2	24.0	24.3
Missouri	14	24.2	22.5	26.7
Montana	5	30.2	26.3	38.1
Nebraska	6	28.2	24.4	29.4
New Hampshire	7	27.0	22.3	35.9
New Jersey	19	20.2	18.8	24.6
New Mexico	18	16.1	15.2	18.3
New York	35	24.5	22.9	29.1
North Carolina	58	22.4	20.7	24.0
North Dakota	4	38.8	35.0	48.4
Ohio	23	18.2	13.4	25.2
Oklahoma	12	17.8	15.6	24.4
Oregon	17	17.8	12.8	25.3
Pennsylvania	14	18.9	18.3	20.4
Rhode Island	1	11.0	10.4	13.8
South Carolina	20	18.3	16.5	23.0
South Dakota	3	50.0	46.7	53.8
Tennessee	13	17.0	15.2	21.0
Texas	54	16.0	14.8	18.9
Utah	1	13.0	13.1	13.9
Vermont	1	15.0	11.2	21.4
Virginia	23	22.3	22.7	21.6
Washington	7	35.7	29.3	38.4
West Virginia	7	18.1	15.6	25.6
Wisconsin	14	45.4	41.9	51.2
Wyoming	7	28.3	24.3	33.4
Grand Total	**821**	**22.8**	**20.7**	**26.0**

APPENDIX B

Table 6.2. Four-Year Award Rates by State, Multivariate Outliers Removed

State	Count of Community Colleges	Four-Year Award Rates		
		All Entering Students	First-Time Students	Not-First-Time Students
Alabama	22	19.7	18.0	22.8
Arizona	19	14.6	12.6	17.2
Arkansas	21	28.5	25.9	31.6
California	96	19.7	19.2	19.7
Colorado	9	30.3	27.4	34.5
Connecticut	11	14.7	13.3	17.8
Florida	1	24.0	21.7	30.5
Georgia	21	27.9	28.1	27.4
Hawaii	6	18.0	16.0	21.4
Idaho	3	19.7	16.6	29.4
Illinois	45	24.1	23.4	25.0
Iowa	16	30.1	27.0	37.4
Kansas	25	35.8	31.8	39.7
Kentucky	16	24.8	23.1	30.3
Louisiana	10	20.3	16.3	24.2
Maine	7	29.1	26.3	36.9
Maryland	16	18.9	16.2	21.7
Massachusetts	16	18.7	16.1	25.8
Michigan	22	18.6	16.0	23.0
Minnesota	29	31.2	27.0	36.7
Mississippi	15	25.2	24.0	24.3
Missouri	13	20.8	19.6	22.9
Montana	5	30.2	26.3	38.1
Nebraska	6	28.2	24.4	29.4
New Hampshire	2	26.5	22.4	35.0
New Jersey	19	20.2	18.8	24.6
New Mexico	17	14.7	13.7	17.1
New York	35	24.5	22.9	29.1
North Carolina	58	22.4	20.7	24.0
North Dakota	3	39.7	35.1	52.0
Ohio	23	18.2	13.4	25.2
Oklahoma	12	17.8	15.6	24.4
Oregon	16	18.0	12.9	25.6
Pennsylvania	13	15.5	14.9	17.5
Rhode Island	1	11.0	10.4	13.8
South Carolina	19	18.1	16.2	22.3
South Dakota	3	50.0	46.7	53.8
Tennessee	13	17.0	15.2	21.0
Texas	54	16.0	14.8	18.9
Utah	1	13.0	13.1	13.9
Vermont	1	15.0	11.2	21.4
Virginia	23	22.3	22.7	21.6
Washington	6	34.5	25.3	38.3
West Virginia	7	18.1	15.6	25.6
Wisconsin	9	46.2	40.5	54.1
Wyoming	7	28.3	24.3	33.4
Total	**792**	**22.4**	**20.4**	**25.5**

*Alaska, Delaware, and Nevada are not included in the model

APPENDIX C

Table 6.3. Revised Descriptive Statistics, Independent Variables

Variable	Label	Count	%	Mean	Std. Dev.
General Characteristics					
Institution Size	Student Enrollment < 5,000 Students*	439	55		
	Student Enrollment >= 5,000 Students	353	45		
Institution Type	High Transfer*	307	39		
	High Career & Technical	199	25		
	Mixed	286	36		
Multi-Institution Control	Part of a Multi-Institution Organization	488	62		
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)			6.76	3.36
Student Enrollment Characteristics					
Percent Part-Time Enrollment	Continuous			58.11	12.12
Percent Adult Student Enrollment	Continuous			32.07	10.96
Percent Non-Degree Seeking Enrollment	Continuous			19.18	12.59
Percent Black, Hispanic, Native American	Continuous			29.73	21.00
Percent Female Enrollment	Continuous			58.41	5.91
Percent Pell Enrollment	Continuous			42.12	13.72
Percent of Students in Online Coursework	Continuous			30.28	15.09
Resources & Expenditures					
Percent Part-Time Faculty	Continuous			60.96	16.60
Revenue from Tuition and Fees**	Continuous, Adjusted for Inflation			2.32	1.30
Revenue from State Appropriations**	Continuous, Adjusted for Inflation			3.78	2.09
Instructional Expenditures per FTE**	Continuous, Adjusted for Inflation			5.83	1.60
Academic Services Expenditures per FTE**	Continuous, Adjusted for Inflation			1.16	0.64
Student Services Expenditures per FTE**	Continuous, Adjusted for Inflation			1.45	0.69
Institutional Services Expenditures per FTE**	Continuous, Adjusted for Inflation			2.12	0.91
State Characteristics					
Unemployment Rate	Continuous			7.5	1.4
Median Household Income**	Continuous			5.7	0.8

Notes: All continuous variables are four-year averages
* Reference group
** Scaled to values of $1,000

APPENDIX D

Table 6.4. Results from Multicollinearity Assessment

Variable	Label	Tolerance	VIF
General Characteristics			
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	0.51	1.95
Institution Size	Student Enrollment >=5,000 Students	0.47	2.13
Institution Type	High Career & Technical College	0.63	1.59
	Mixed Career & Technical / Transfer College	0.74	1.35
Multi-Institution Control	Part of a Multi-Institutional Organization	0.84	1.20
Student Enrollment Characteristics			
Percent Part-Time Enrollment	Continuous	0.50	1.98
Percent Adult Student Enrollment	Continuous	0.70	1.43
Percent Non-Degree Seeking Enrollment	Continuous	0.70	1.42
Percent Black, Hispanic, Native American	Continuous	0.60	1.67
Percent Female Enrollment	Continuous	0.66	1.52
Percent Pell Enrollment	Continuous	0.43	2.30
Percent of Student Enrolled in Online Coursework	Continuous	0.76	1.31
Resources & Expenditures			
Percent Part-Time Faculty	Continuous	0.98	1.02
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	0.66	1.51
Revenue from State Appropriations	Continuous, Adjusted for Inflation	0.63	1.60
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.60	1.67
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.70	1.44
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.71	1.41
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.67	1.50

APPENDIX E

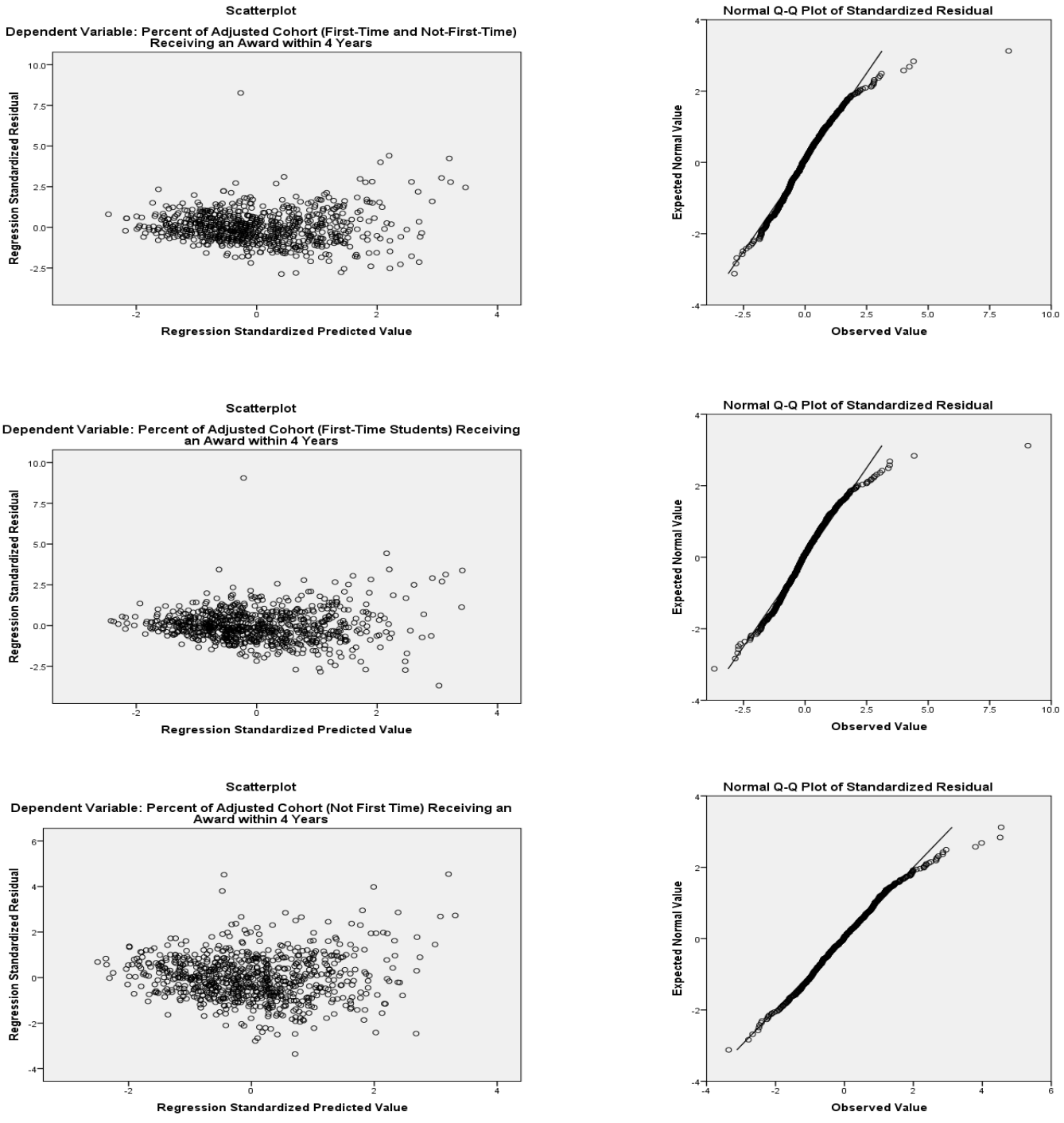

Figure 6.1. Scatterplots and Normal Q-Q Plots of Dependent Variables, Pre-Transformation. Analyses of residual statistics used to assess potential violations of the normality and homoscedasticity assumptions.

APPENDIX F

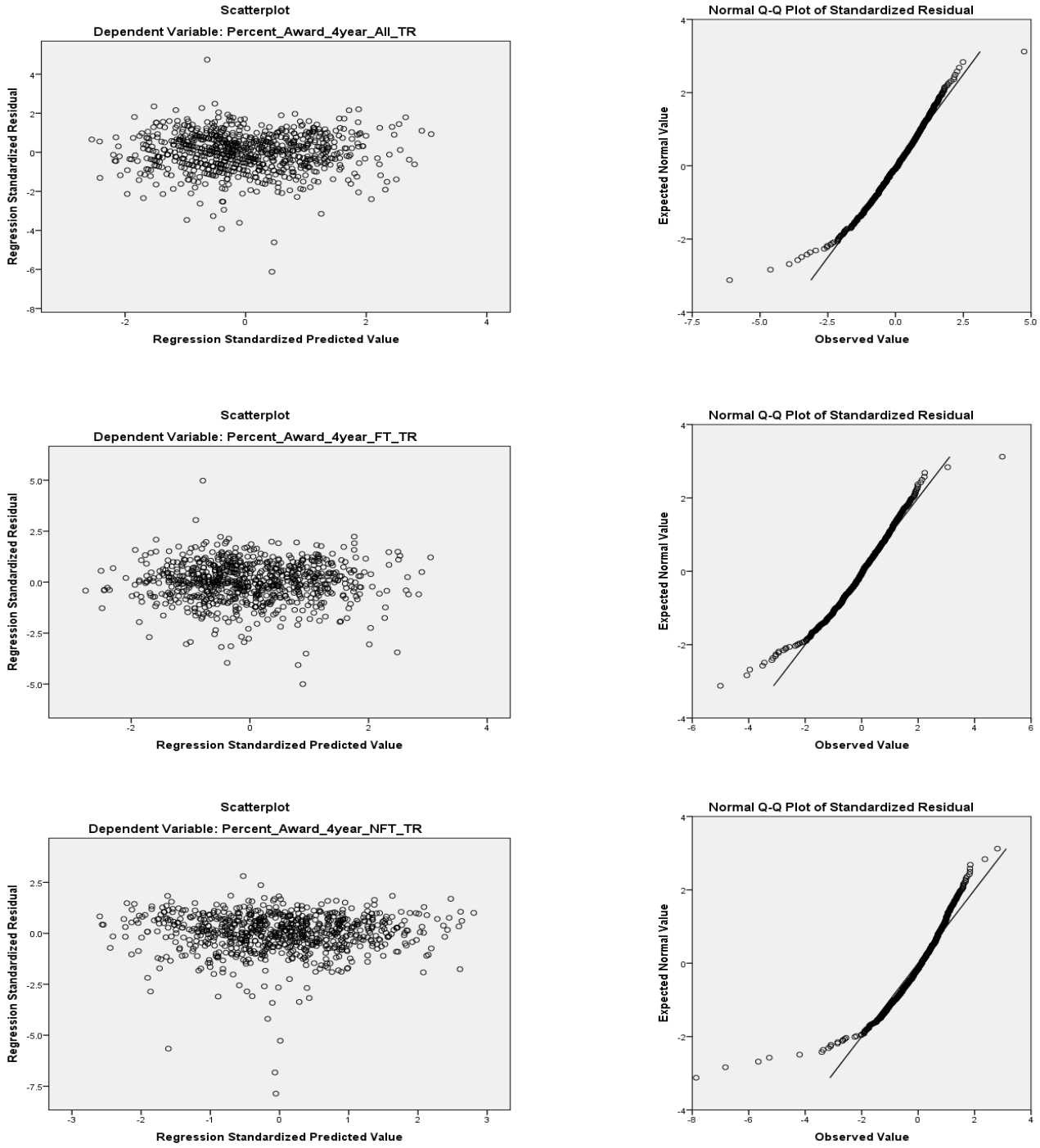

Figure 6.2. Scatterplots and Normal Q-Q Plots of Dependent Variables, Post-Transformation. Analyses of residual statistics after applying a log transformation to the dependent variables. Due to a zero-value contained in the not-first-time student award rate, the log transformation became *ln(y+1)*.

APPENDIX G

Table 6.5. Results of Chi-Square Test of Deviance (Model Fit)

Award Rate	Null Deviance	Level 1 Deviance	Sig	Level 2 Deviance	Sig
All Entering Students	670.167	359.407	0.000	352.043	0.025
First-Time Entering Students	764.361	431.198	0.000	426.612	0.101
Not-First-Time Entering Students	5916.288	5668.431	0.000	5658.003	0.005

Note: Deviance is based on -2 Log Likelihood

APPENDIX H

Table 6.6. OLS Regression Results for Not-First-Time Student Award Rates, Log Transformed

Variable	Label	b	Exp(b)-1	Std. Error	β	*t*	Sig	R^2
Constant		3.479		0.199		17.448	***	
General Characteristics								*0.138*
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.010	-0.009	0.006	-0.067	-1.602		
Institution Size	Student Enrollment >=5,000 Students	0.044	0.045	0.042	0.046	1.052		
Institution Type	High Career & Technical College	0.237	0.267	0.042	0.215	5.693	***	
	Mixed Career & Technical / Transfer College	0.052	0.053	0.035	0.052	1.489		
Multi-Institution Control	Part of a Multi-Institutional Organization	0.030	0.030	0.032	0.030	0.931		
Student Enrollment Characteristics								*0.270*
Percent Part-Time Enrollment	Continuous	-0.009	-0.009	0.002	-0.224	-5.309	***	
Percent Adult Student Enrollment	Continuous	0.002	0.002	0.002	0.050	1.402		
Percent Non-Degree Seeking Enrollment	Continuous	0.007	0.007	0.001	0.184	5.172	***	
Percent Black, Hispanic, Native American	Continuous	-0.004	-0.004	0.001	-0.197	-5.095	***	
Percent Female Enrollment	Continuous	-0.008	-0.008	0.003	-0.100	-2.708	**	
Percent Pell Enrollment	Continuous	0.004	0.004	0.002	0.110	2.425	**	
Percent of Student Enrolled in Distance Education	Continuous	2.21E-03	2.21E-03	0.001	0.070	2.038	**	
Resources & Expenditures								*0.292*
Percent Part-Time Faculty	Continuous	1.02E-03	1.02E-03	0.001	0.035	1.173		
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	0.003	0.003	0.014	0.008	0.226		
Revenue from State Appropriations	Continuous, Adjusted for Inflation	-0.013	-0.013	0.009	-0.056	-1.494		
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.033	0.033	0.012	0.109	2.815	**	
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.011	-0.011	0.027	-0.014	-0.396		
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.043	0.044	0.025	0.063	1.763	*	
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.033	0.034	0.019	0.064	1.740	*	

Note. *p<0.10; **p<0.05; ***p<0.01

Table 6.7. Multilevel Model Results for Not-First-Time Student Award Rates, Log Transformed

Variable	Label	b	Exp(b)-1	Std. Error	*t*	Sig
Intercept		2.272		0.182	12.514	***
General Characteristics						
Degree of Urbanization	Ordinal, Most Rural (1) - Most Urban (12)	-0.012	-0.012	0.006	-2.162	**
Institution Size	Student Enrollment >=5,000 Students	0.258	0.295	0.044	5.824	***
Institution Type	High Career & Technical College	0.071	0.073	0.035	2.038	**
	Mixed Career & Technical / Transfer College	0.033	0.034	0.040	0.832	
Multi-Institution Control	Part of a Multi-Institutional Organization	0.008	0.008	0.037	0.222	
Student Enrollment Characteristics						
Percent Part-Time Enrollment	Continuous	-0.010	-0.010	0.002	-5.483	***
Percent Adult Student Enrollment	Continuous	0.003	0.003	0.002	1.770	*
Percent Non-Degree Seeking Enrollment	Continuous	0.009	0.009	0.002	5.910	***
Percent Black, Hispanic, Native American	Continuous	-0.004	-0.004	0.001	-4.275	***
Percent Female Enrollment	Continuous	-0.005	-0.005	0.003	-1.581	
Percent Pell Enrollment	Continuous	0.007	0.007	0.002	3.960	***
Percent of Student Enrolled in Distance Education	Continuous	0.003	0.003	0.001	2.652	***
Resources & Expenditures						
Percent Part-Time Faculty	Continuous	0.001	7.38E-04	0.001	0.902	
Revenue from Tuition and Fees	Continuous, Adjusted for Inflation	0.001	0.001	0.002	0.799	
Revenue from State Appropriations	Continuous, Adjusted for Inflation	-0.020	-0.020	0.010	-2.062	**
Instructional Service Expenditures per FTE	Continuous, Adjusted for Inflation	0.003	0.003	0.001	2.740	***
Academic Services Expenditures per FTE	Continuous, Adjusted for Inflation	-0.002	-0.002	0.003	-0.899	
Student Services Expenditures per FTE	Continuous, Adjusted for Inflation	-1.70E-04	0.000	0.003	-0.066	
Institutional Services Expenditures per FTE	Continuous, Adjusted for Inflation	0.004	0.004	0.002	1.864	*
State Characteristics						
Average Unemployment Rate	Continuous	-0.016	-0.016	0.019	-0.821	
Average Median Household Income	Continuous	9.40E-06	0.000	3.13E-06	3.004	***

Note. *p<0.10; **p<0.05; ***p<0.01

VITA

A native East Tennessean, Jacob Andrew Kamer was born in Knoxville and raised in the rural community of Oakdale. In 2008, he graduated from Oakdale School as salutatorian of his senior class. Following high school graduation, Mr. Kamer attended Roane State Community College in Harriman, Tennessee, where he graduated with an Associate of Science degree in 2010. That same year, he continued his studies at Tennessee Technological University in Cookeville, Tennessee, from where he would earn his Bachelor's in English in 2012. In 2015, he completed a Master of Business Administration from King University in Bristol, Tennessee. In 2016, he enrolled at the University of Tennessee, Knoxville, to pursue his doctorate in Higher Education Administration.

From November 2012 to January 2017, Mr. Kamer served as an enrollment counselor in the admissions office of King University. In his spare time, he served on the board of directors of Friends of Literacy, a local non-profit organization centered around adult basic education, from 2013 to 2019. In January 2017, during the course of his doctoral studies, he accepted an assistantship at the University of Tennessee, Knoxville. He has been the Graduate Research Assistant in the Center for Educational Leadership, under the supervision of Dr. Jim McIntyre, and in the Office of Institutional Research & Assessment, under the leadership of Dr. Denise Gardner. In January 2020, Mr. Kamer joined the Tennessee Higher Education Commission as a research analyst in the Policy, Planning and Research Bureau. He currently resides in Nashville.