EXAMINING THE EFFECTS OF TUITION DISCOUNTING ON STUDENT ENROLLMENT AND COMPOSITION AT PUBLIC FOUR-YEAR COLLEGES AND UNIVERSITIES

by

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(Under the Direction of Robert K. Toutkoushian)

ABSTRACT

As a growing number of colleges and universities have begun to implement tuition discounting policies, higher education researchers have continuously assessed their effectiveness as an enrollment management tool. Because few studies thus far have explored the institutional changes that tuition discounting has brought to public colleges and universities, this study seeks to understand the impact of tuition discounting on student enrollment and composition at public four-year colleges and universities. A multidimensional conceptual framework is employed to understand the use of tuition discounting at colleges and universities. The economic concepts of supply, demand, and the competitive market, the microeconomic theory of nonprofit firm behavior, and price discrimination provide a greater understanding of why colleges and universities have used tuition discounting practices rather than other approaches. The concepts of consumer surplus and cost/benefit analysis supplement the conceptual framework to help explain the effectiveness of tuition discounting practices from a student perspective. Based on this framework, the current dissertation study takes a quantitative research approach using data obtained from publicly available sources, such as the U.S. Department of Education's NCES and the Institute for College Access and Success IPEDS database (TICAS). Overall, the findings

suggest that tuition discounting was not a useful tool in increasing student enrollment at four-year public colleges and universities. However, it has been effective in diversifying student composition by increasing the percentage of some underrepresented minority student groups and low-income students. The findings also indicate that institution and state-level factors can moderate the relationships between tuition discounts and student enrollment outcomes, thereby emphasizing the need for considering such moderating factors. Lastly, the findings suggest that, although public colleges and universities still provide institutional grants based more on students' financial needs than on their non-financial factors, the shifts from need-based to non-need-based aid may possibly reduce the percentages of underrepresented minority and low-income students at public four-year colleges and universities.

INDEX WORDS: Tuition Discounting, Student Enrollment, Student Composition, Public Colleges and Universities

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MS, The University of Wisconsin-Madison, 2018

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2022

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August 2022

DEDICATION

For my parents: my source of courage.

ACKNOWLEDGEMENTS

I want to express my gratitude to my family members and mentors. I am first grateful to my mother, father, and brother. Without their unconditional love, constant encouragement, and prayer, I would not have been able to take on this challenge and complete my doctoral journey. Thank you for always believing in me and being part of my life. I love you.

I would also like to thank the members of my committee, Dr. Toutkoushian, Dr. Hearn, and Dr. Wolniak. Their deep insights, guidance, and assistance made the final dissertation stronger. Special thanks to my advisor, Dr. Toutkoushian. He always offered invaluable expertise and encouraged me through my doctoral program at MIHE. His genuine kindness and understanding were truly appreciated. I will never be able to thank him enough for all he has done for me over the years. Thank you, Dr. Toutkoushian.

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Introduction

Defined as the practice of providing institutionally funded financial aid to students, tuition discounting has been a long-standing practice in higher education in the United States. Traditionally, colleges and universities, particularly those in private sector, awarded tuition discounts to students who demonstrated financial need, expecting the aid offset the "sticker price" students pay for college (Hubbell et al., 2002). However, in recent years, a growing number of colleges and universities in both the public and private higher education sectors have begun to strategically use tuition discounting to achieve various institutional objectives (e.g., institutional prestige, student diversity, and revenue generation), and the size of tuition discounts has continued to increase (Davis, 2003; Doyle, 2010; Doyle et al., 2009; Duggan & Mathews, 2005; Hillman, 2010; Lapovsky & Hubbell, 2003; Lassila, 2010).

Prior studies have identified several factors contributing to the growing use of tuition discounting practices in higher education institutions (Baum et al., 2010; Breneman et al., 2001; Davis, 2003; Hillman, 2012; Horn & Peter, 2003; Hubbell et al., 2002; Redd, 2000; Winston, 1997). For instance, relatively stagnant numbers of high school graduates and college enrollees has prompted fierce recruitment competitions among higher education institutions across all sectors, and led these institutions to adopt tuition discounting practices. One report indicated that high school graduation rates from 2005 to 2016 increased by approximately four percent (DeBrey et al., 2021). However, the percent of recent high school graduates enrolled in college increased slightly from 68.6 percent in 2005 to 69.8 percent in 2016 (DeBrey et al., 2021).

Consequently, these trends in the student body have led more and more institutions to adopt tuition discounting practice as a way to increase total enrollment.

Concerns regarding institutional image due to the growing popularity of college rankings (e.g., *US News and World Report*) have also caused colleges and universities to use tuition discounting practices (Duffy & Goldberg, 2014). Because recruiting academically talented students or students from diverse backgrounds is key to promoting a desirable institutional image and climate (Astin, 1993; Chang, 1999; Milem & Hakuta, 2000), colleges and universities that aim to enhance their prestige or increase student diversity have strategically discounted tuition and fees for students whose enrollment can advance institutional competitiveness or diversity (Baum et al., 2010; Hillman, 2010; Redd, 2000).

Competition among institutions has provided at least part of the impetus for the gradual implementation of tuition discounting practices among higher education institutions. In addition, the use of tuition discounting has become prevalent due to reduced governmental support for higher education (Hossler et al., 1997; Kane, 2003; Toutkoushian & Hollis, 1998). At the federal level, the diminishing purchasing power of Pell Grants alongside tuition inflation has triggered the use of tuition discounting practices in many postsecondary institutions (Baum & Ma, 2010; Hillman, 2012; Protopsaltis & Parrott, 2017). While Pell Grants subsidized a large portion of college costs in the 1970s, today's maximum award only covers one third of the costs of attending a public university (Goldrick-Rab, 2016; Protopsaltis & Parrott, 2017). Meanwhile, tuition and fees at higher education institutions have exponentially increased. Tuition and fees at private four-year colleges and universities rose approximately 155 percent between 1992 and 2009; for public four-year institutions, published tuition and fees rose about 133 percent (Ma et al., 2019; Snyder & Dillow, 2011). At the state level, the size of subsidies for higher education

has gradually decreased over the past several decades due to economic, political, and demographic changes (Kane et al., 2003; Hossler et al., 1997; Toutkoushian & Hollis, 1998). As these increases and reductions continue unabated, public higher education institutions that have relied heavily on state subsidies have decided to raise tuition and fees to compensate the lost state revenue. However, while charging high tuition, these institutions have also offered tuition discounts for some students, hoping the discounts would offset the higher prices. Accordingly, the current climate of higher education finance has induced not only private but also public higher education institutions to adopt tuition discounting practices.

Given this context, it is not surprising that tuition discounting has become a common enrollment and/or revenue management strategy for higher education institutions. Between the academic years of 2010-11 and 2018-19, for instance, the average tuition discount rate for private, nonprofit colleges and universities increased from 42 percent to 51.2 percent for first-time, full-time undergraduate degree-seeking students, and from 36.4 percent to 46 percent for all undergraduate students (2018 NACUBO Tuition Discounting Study, 2019). Although the size of tuition discounts was relatively lower than that of private colleges and universities, public higher education institutions also allocated a significant amount of institutional revenue in order to offer institutional aid. According to the College Board, between 2006-07 and 2017-18, the average institutional grant aid per first-time, full-time student at public four-year institutions increased from $1,600 to $3,370, after adjusting for inflation (Ma et al., 2020). With respect to the types of tuition discounts that these institutions provide, approximately 46 percent of institutional aid was awarded to students without financial need at private four-year institutions, whereas approximately 27 percent of grant aid went to non-need-based students at public four-year institutions in 2007-08 (Baum et al., 2010).

Problem Statement

As the use of tuition discounting in higher education institutions has become more prevalent, researchers have started to explore its effects on various institutional outcomes such as aggregate enrollment, student composition, institutional revenue, and institutional standing (Browning, 2013; Duggan & Mathews, 2005; Ehrenberg et al., 2006; Hillman, 2010; Lassila, 2010; Toutkoushian & Hillman, 2012). The body of research that analyzes the relationship between tuition discounting and total enrollment provides empirical evidence that tuition discounting has increased aggregate enrollment, although its effects could vary by institutional contexts and types (Davis, 2003; Duggan & Mathews, 2005; Lapovsky & Hubbell, 2003; Lassila, 2010; Redd, 2000). Additional literature has analyzed how tuition discounting can influence student access and diversity in higher education institutions. Overall, studies on these topics have yielded somewhat more negative than positive findings, suggesting that tuition discounting has tended to hinder low-income students' access to grant aid and limit their opportunities to choose a four-year institution over a two-year institution (Davis, 2003; Duggan & Mathews, 2005; Heller, 2006; Hillman, 2010; Hubbell et al., 2002; Lassila, 2010; Reinoehl & Kowalski, 2015). With regards to expanding institutional revenue, prior studies have found that tuition discounting yields limited financial benefits to institutions and reduces institutions' spending in areas such as student services and instruction (Breneman et al., 2001; Davis, 2003; Duggan & Mathews, 2005; Fain, 2010; Geiger & Heller, 2012; Hillman, 2010, 2012; Lapovsky & Hubbell, 2003; Noel-Levitz, 2012; Redd, 2000). Some of the tuition discounting literature is also devoted to examining the policy's effectiveness on increasing institutional selectivity and to providing evidence of the limited role that tuition discounting might play in enhancing

institutional competitiveness (Davis, 2003; Illumination 2003; Redd, 2000; Reinoehl & Kowalski, 2015).

Despite the growing scholarly interest in tuition discounting, its impact on public higher education institutions merits further attention for several reasons. While prior researchers have explored how tuition discounting rates are associated with various institutional outcomes, only a handful of studies have focused on examining the effect of tuition discounting at public colleges and universities specifically (e.g., Baum et al., 2010; Doyle et al., 2009; Hillman, 2010, 2012). Accordingly, these results have provided only limited implications for tuition discounting policies for public higher education institutions. Additionally, few studies have explored the relationship between tuition discounting and student enrollment and composition in subsectors of public colleges and universities, although the existing differences among these institutions can lead to different results. Even among studies that try to explore the impact of tuition discounting by institutional type, only few studies examined the effects of different types of tuition discounts (i.e., need-based or non-need-based) on student enrollment outcomes. Lastly, no studies take into account the possibility of institution- and state-level moderators that may influence the relationships between tuition discounting and the changes in student enrollment.

Statement of Purpose

This study focuses on the impacts of tuition discounting practices at public colleges and universities in the United States over a period of 11 years. First, this study traces trends in tuition discounting rates and various student enrollment outcomes at public four-year colleges and universities that vary in institutional selectivity. Second, this study examines the impact of tuition discounting on the institutional outcomes of aggregate enrollment and student composition at public higher education institutions. Third, the study explores whether the changes in

institutional emphasis on awarding need-based institutional grants over non-need-based institutional grants shape student enrollment and composition. Fourth, this research also assesses whether the relationships between tuition discounting and various student enrollment outcomes are moderated by institution- and state-level factors. Lastly, the study analyzes the effectiveness of tuition discounts as an enrollment management strategy.

Research Questions

Considering the complex nature of tuition discounting in higher education institutions, this study attempts to examine the heterogeneous effects that tuition discounting can bring to institutions with different institutional contexts. To that end, this study addresses the following questions:

- Question 1: How does tuition discounting affect public higher education institutions with respect to student enrollment and student body composition?
  A. Do these relationships vary by institutional selectivity?
  B. Are these relationships amplified or weakened by factors such as institutional selectivity, state-level financial aid policy, and institutional financial health?
- Question 2: How does institutions' emphasis on awarding institutional grants based on students' financial need over non-financial aspects influence student enrollment and composition?

To answer these questions, this dissertation utilizes descriptive statistics and regression analysis using a panel dataset constructed from several publicly available data sources. The panel data spans the years 2008-2018 and includes all public four-year colleges and universities that provide information about tuition discounts.

Significance of the Study

The first significant aspect of this dissertation study is its exploration of the effect of tuition discounting practices at public colleges and universities. Postsecondary institutions in the public and private sectors are substantially different from one another; private colleges and universities have more autonomy in setting tuition and fees as well as in providing institutional financial aid relative to their counterparts in the public sector. For instance, in recent years, some private colleges and universities have substantially reduced their tuition and fees and removed their financial aid offers to incoming undergraduate students, expecting that this "tuition reset" practice would lead their institutions to be more competitive in recruiting desired students (Seltzer, 2017). On the other hand, for public colleges and universities, the governing boards of public institutions set different designated tuition rates for in-state and out-of-state students, thereby institutions in the public sector are not able to strategically utilize tuition and fees to increase student enrollment. Instead, public colleges and universities may offer different levels of tuition discounts based on students' state of residency. Given this context, it is plausible that the effects of tuition discounting on student enrollment at private and public colleges and universities can differ from their effect at private colleges and universities. Thus, by exploring the relationship between tuition discounting and student enrollment outcomes at public postsecondary institutions specifically, the study's results can show whether tuition discounting generates meaningful enrollment gains for public colleges and universities, and whether tuition discounting is as an effective enrollment management strategy at public institutions as it has been at private postsecondary institutions.

The impact of tuition discounting practices on subsectors of public postsecondary institutions also merits attention because only a handful of prior studies differentiate between

institutional characteristics or types, thus leading to a sizable gap in the literature. It may be the case that tuition discounting policies may not yield uniform outcomes for all types of higher education institutions. For instance, more selective institutions that receive a high volume of applications from academically talented students are better at achieving their enrollment goal regardless of which students the institutions offer tuition discounts. On the other hand, for less selective institutions, the same practice of tuition discounting may not be an effective strategy to recruit students. Thus, by investigating how tuition discounting influences institutions of different levels of selectivity and institutional contexts, this dissertation study offers a more comprehensive understanding of tuition discounting practices.

Furthermore, the result of this study contributes to the literature of tuition discounting by providing information about whether tuition discounting policies are more effective in some types of institutions than others. This is critical because prior literature has questioned the effectiveness of tuition discounting as an enrollment management strategy, and yet it is still unclear whether these inconsistent findings have resulted from differences in institutional contexts. Therefore, by conducting analysis by different institutional selectivity, this study enables higher education policymakers and practitioners to clearly determine whether tuition discounting policy is more effective in particular types of institutions. At the same time, the results may aid in calls for policy interventions that readjust states' current higher education policies based on institutional contexts.

Similarly, this dissertation study tries to fill a research gap in tuition discounting literature by examining whether institutions have begun to award their institutional grants based on students' financial need over other aspects, and whether the emphasis on a certain type of institutional grant (e.g., need-based or non-need-based) influences student enrollment and

student body composition within institutions. Prior studies provided evidence that a growing number of higher education institutions have begun to provide their tuition discounts based on students' academic performance rather than their financial need. Although this shift may not be apparent in the public higher education institution sector, the results of this study enable institutional leaders and policy makers to see how such a shift in tuition discounting practice may impact student enrollment and composition in certain ways and possibly offer some evidence of the changing institutional priorities of public postsecondary institutions.

Additionally, the study also expands knowledge regarding whether institutional characteristics in state-level contexts of higher education finance policy and institutional financial health moderate the associations between tuition discounting and student outcomes. This is of particular importance given that no prior research has attempted to explore whether the effect of discounts may be amplified or weakened by these state and institutional circumstances. Accordingly, the results of this study have the potential to present evidence that researchers need to consider institutional and state-level circumstances when analyzing the impacts of tuition discounting, since these factors may moderate the relationship between tuition discounting and institutional outcomes.

Lastly, most of the extant literature on tuition discounting is descriptive in nature. Only a handful of studies employ more sophisticated statistical methods, yet these studies often use cross-sectional data or data from a single institution (Curs, 2008; Curs & Singell Jr., 2010; Hillman, 2010; Lassila, 2011). Although these studies still provide valuable insights about tuition discounting, the results obtained from more rigorous statistical approaches will allow researchers to move from identifying relationships to affirming causalities. Additionally, cross-sectional analysis may not capture noteworthy changes affecting the association between tuition

discounting and institutional outcomes over time. Therefore, to that extent, this dissertation anticipates that more unbiased relationships between tuition discounts and student enrollment and composition will become apparent in the long run.

Organization of Dissertation

This dissertation consists of five chapters. This chapter presented an introduction to the dissertation. Chapter 2 begins by reviewing the broad areas of literature upon which this dissertation builds: (1) the origins and definitions of tuition discounting practices and (2) the various effects that tuition discounting has brought to higher education institutions. This section also discusses theoretical perspectives that provide an understanding of how colleges and universities make decisions regarding the use of tuition discounting practices: the economic concepts of supply, demand, and competitive market, the microeconomic theory of nonprofit firm behavior, consumer surplus and price discrimination, and cost/benefit anaysis. Chapter 3 provides the methodology, discussing analytical strategies used to address the previously stated research questions. Chapter 4 shows the results of the analysis of the data. Finally, Chapter 5 concludes the analysis and discusses implications driven from the study's findings.

Chapter 2

Literature Review

This chapter summarizes the literature pertaining to tuition discounting: its definition, its history of adoption in different sectors of higher education institutions, and the research literature addressing the impacts of tuition discounting on institutional outcomes such as aggregated enrollment, student diversity, institutional standing, and institutional revenue. After the literature review on tuition discounting, the researcher describes the theories guiding this dissertation: the economic concepts of supply, demand, and market competition, the microeconomic theory of a nonprofit firm, consumer surplus and price discrimination, and the concepts of cost/benefit analysis. Lastly, a series of hypotheses related to the associations between tuition discounting and student enrollment and diversity is presented.

Definition of Tuition Discounting

Tuition discounting has been a long-standing practice in colleges and universities. Broadly considered as a practice of customizing institutional financial aid packages to increase total enrollment (Lamkin, 2003; Reed & Shireman, 2008), it, in essence, represents all tuition revenue intentionally foregone by institutions. This is because by reducing the net price for some students, higher education institutions lose the tuition revenue they would have received from these students.

Allan (1999) outlined three successive broader definitions of tuition discounting: simple tuition discount, scholarship allowance, and student tuition discount. The *simple tuition discount* solely indicates the portions of a tuition waiver that are not funded from either an internal source

(e.g., institutional financial aid funded from gifts and endowments) or an external one (e.g., Pell Grants). The *scholarship allowance* is a more inclusive definition of tuition discounting relative to the simple tuition discount. This concept consists of all financial aid funded from the institution; it means simple tuition discounts in addition to aid funded by gifts and endowments. By including tuition funded by gifts and endowments, the scholarship allowance treats the operating and endowment funds as a single financial entity. Consequently, this allows financial analysts to examine more accurate inflows and outflows of institutions' financial resources (Allan, 1999). Lastly, the *student tuition discount* is the broadest of these concepts. Defined as the total of tuition that students do not have to pay out-of-pocket, student tuition discounts consist of scholarship allowances and all external scholarships and grants funded by external sources (i.e., federal and state governments and private institutions). This concept is especially important for admissions directors and enrollment managers as well as students and parents, since the net price of attending college is a crucial factor in students' college enrollment decisions (Allan, 1999).

Among the three definitions, that of scholarship allowances is the most commonly used by scholars (Davis, 2003; Hubbell et al., 2002; Redd, 2000). The National Association of College and University Officers (NACUBO) has used this definition for its tuition discount surveys since 1999. Additionally, the Financial Accounting Standards Board, which sets the rules of financial accounting and reporting for private higher education institutions, also utilized this definition when drafting its new rules for reporting tuition discounting (Allan, 1999).

History of Tuition Discounting

During the 1960s and early 1970s, government officials and college administrators believed that reducing financial costs through need-based financial aid could potentially

influence students' decisions to enroll in college (Davis, 2003; Hubbell et al., 2002). Consequently, various federal as well as state-level need-based financial aid programs were created and offered to students who demonstrated financial need. During this time, colleges and universities, in particular those in the private sector, took on this role as well and offered institutional aid when federal and state financial assistance did not fully cover the costs of attendance that could be borne by students and their families (Davis, 2003).

However, beginning in the late 1970s, some colleges and universities gradually felt compelled to rearrange their tuition discounting practices by awarding institutional aid not only to low-income students, but also to middle and upper-income students. They were concerned that the slower growth in the number of high school graduates in the late 1980s would impede them from meeting their enrollment goals and negatively impact institutional revenue (Redd, 2000). For these institutions, tuition discounting was a reasonable approach to take, since some students and their families are price-sensitive. Consequently, tuition discounting's original goal of helping low-income students became intertwined with various institutional goals of enrollment management and revenue generation. Since then, a growing number of colleges and universities, including those in the public sector, have started to provide strategic tuition discounts for students who meet the criteria of their institutional preferences (Duggan & Mathews, 2005; Hubbell et al., 2002).

In addition to concerns about meeting enrollment expectations, the growing popularity of college rankings has also led both private and public colleges and universities to adopt strategic tuition discounting practices (Baum et al., 2010; Duffy & Goldberg, 1998; Hillman, 2010; Redd, 2000). Given the fact that college rankings are determined by factors such as SAT scores and admissions rates, the institutions that aim to enhance their rankings have begun to offer tuition

discounts to higher-achieving students whose enrollment would advance institutional competitiveness and prestige (Baum et al., 2010; Redd, 2000). As such, an increasing number of postsecondary institutions have directed their financial resources towards tuition discounting to attract academically talented students.

The use of tuition discounting was also accelerated due to the diminishing purchasing power of the Pell Grant resulting from tuition inflation (Baum & Ma, 2010; Hillman, 2012; Protopsaltis & Parrott, 2017). While the Pell subsidized a large part of the costs of attending colleges in the 1970s, today's maximum Pell only covers one-third of the costs of attending a public university (Goldrick-Rab, 2016; Protopsaltis & Parrott, 2017). Meanwhile, institutions have also faced gradual reductions in state subsidies for higher education. Although state appropriations have been one of the largest revenue sources for financing institutional operations (Hossler et al., 1997; McGuinness, 1999; Toutkoushian & Hollis, 1998), these subsidies have decreased over the past several decades due to various economic, political and demographic changes (Kane et al., 2003). Consequently, higher education institutions have become more reliant on tuition, shifting their financial burden to parents and students. These changes in federal and state-level higher education circumstances, accordingly, have led both public and private higher education institutions to offer tuition discounts to some students, in hope that the reduced college cost will enable these students to attend their institution.

Overall, while increasing competition among institutions and the growing dependency on tuition revenue may not automatically lead higher education institutions to adopt or redesign their tuition discounting practices, these external factors have triggered both private and public colleges and universities to engage in strategic tuition discounting practices. Given the circumstances, it is likely that the use of tuition discounts generates some effects on both

students and higher education institutions. As Duggan and Mathews (2005) argued, institutional grants are no longer offered based on students' financial need. Additionally, more and more institutions use their tuition revenue to finance tuition discounts. Together, these trends suggest a need to examine whether tuition discounting is an effective strategy to achieve institutions' desired goals of increasing the enrollment of new students and diversifying the student body by admitting more students from different racial/ethnic and socioeconomic backgrounds.

Findings from Empirical Studies on Tuition Discounting

Although a large body of literature has explored tuition discounting by this point, only a handful of studies specifically examine the role of tuition discounting on increasing aggregate enrollment and student composition (Breneman et al., 2001; Curs, 2008; Davis, 2003; Duggan & Mathews, 2005; Heller, 2006; Hillman, 2010; Lassila, 2010; Redd, 2000; Reinoehl & Kowalski, 2015). This dearth of studies focusing on total enrollment and student composition is surprising given that higher education institutions are a crucial contributor of student financial aid. Overall, studies examining the effectiveness of tuition discounting as an enrollment management tool have yielded somewhat more negative findings, but the literature remains mixed.

Effect of Tuition Discounting on Total Enrollment

Studies analyzing the relationship between tuition discounting and total enrollment have discovered both positive and negative associations (Davis, 2003; Duggan & Mathews, 2005; Lassila, 2010; Redd, 2000). For instance, using fall 2004-05 data from the Integrated Postsecondary Education Data System (IPEDS), Lassila (2010) examined whether tuition discounting is related to total enrollment at private, not-for-profit institutions. The study found a positive relationship between the institutional tuition discount rate and aggregate enrollment and concluded that tuition discounting practices may be an effective approach for private colleges

and universities that aim to increase their aggregate enrollment. Yet, it is limited in that the researcher was not able to differentiate between the different types of institutional aid (i.e., merit-based aid versus need-based aid) that students received. As a result, Lassila was unable to conclude whether aggregate enrollment growth was the result of the enrollment of students with financial need or of students with academic ability or special talents.

In contrast to Lassila's finding, some studies discovered that tuition discounting has a somewhat limited role in achieving desired enrollment goals (Davis, 2003; Redd, 2005). Using National Postsecondary Student Aid Survey (NPSAS) enrollment data from 1995-1996 and 1999-2000, Davis (2003) studied four-year private and public institutions and found that despite the use of tuition discounting, the widening gaps in tuition and fee charges led dependent and independent undergraduate students with various income ranges to enroll in public rather than private institutions. Based on these results, Davis claimed that the use of tuition discounting was not an effective enrollment management tool for private colleges and universities in general. Like Davis, Redd's research (2005) yielded comparable findings using NACUBO data collected from 275 four-year private colleges and universities and IPEDS enrollment data. The researcher found that private institutions with the largest growth in discounting experienced the steepest declines in aggregate undergraduate enrollments, whereas institutions with average and below-average growth in discount rates experienced an 11 percent increase in their total enrollment. Based on this result, Redd argued that a large increase in discounting is not truly associated with students' decision to attend a private institution that offers tuition discounting, since students also consider non-financial factors such as academic quality and campus location in addition to discount rates when making college decisions.

Overall, prior research has suggested that tuition discounting seems to be a marginally effective enrollment management strategy that is likely to produce mixed enrollment results. To be specific, the findings show that the effect of tuition discounting on total enrollment may differ by an institution's characteristics, and that tuition discounting along with increased tuition rates may not result in desired enrollment outcomes. However, future research on this topic is necessary for several reasons. First, existing studies are few and have mainly used data from private colleges and universities, thereby limiting our understanding of the effect of tuition discounting on aggregate enrollment at public postsecondary institutions. Additionally, although the effect of tuition discounting may differ by institutional type and/or characteristics, only a handful of studies have tried to explore whether this hypothesis is indeed true. Furthermore, the outdated data used in these studies hampers researchers in determining whether the effects of tuition discounting on total enrollment have changed significantly over the years. Lastly, it is unclear why these studies provide substantially different results, though differences in statistical methodologies and datasets likely explain some of the discrepancies. As such, further research incorporating more rigorous statistical methods is necessary to examine whether aggregate enrollment with respect to various institutional types and characteristics is influenced by tuition discounting in varying ways.

Effect of Tuition Discounting on Student Composition

Researchers have also connected tuition discounting to institutional outcomes of student access and composition at both private and public higher education institutions. These studies assessed the relationship between tuition discounting and the enrollment of low-income and underrepresented minority students. Overall, studies on these topics have yielded somewhat

more negative than positive findings and suggest educational equity concerns remain significant for historically marginalized student populations.

Socioeconomic Diversity

Several studies have examined tuition discounting and its consequences on low-income students and found mixed results. Using the data from the NACUBO institutional aid survey collected from 275 private, four-year colleges and universities, Redd (2000) conducted a comprehensive study, asserting that tuition discounting allowed more lower-income students to access to higher education. Specifically, the study found that the number of Pell recipients increased by 20 percent at institutions with the largest rise in tuition discounting and by 16 percent at institutions with the smallest increases in discounting. Curs (2008) also found a positive relationship between tuition discounting and the enrollment decisions of students with financial need. When examining a sample of freshman applicants to the University of Oregon, the study revealed that $1,000 in merit-based aid increased the likelihood of financially needy students' enrollment by 6.8 percent. However, this result may be an overestimation, since a potential correlation between merit-based aid and error term can exist.

However, these studies were refuted by several other studies that showed that tuition discounting is not an effective approach for increasing low-income students' access to higher education institutions of their choosing (Davis, 2013; Duggan & Mathews, 2005; Hillman, 2010; Reinoehl & Kowalski, 2015). For instance, using NPSAS data collected between 1995-1996 and 1999-2000, Davis (2003) found that the growth in the average dollar amount of institutional grants awarded to higher-income students outpaced the growth for lower-income students at both private and public colleges and universities. Additionally, the study provided evidence of a significant tuition gap between public and private postsecondary institutions and suggested that,

even with tuition discounts offered by private institutions, this trend in tuition gaps forced lower-income students to choose a public institution over a private institution. Duggan and Matthews (2005) yielded similar findings using much richer source data regarding tuition discounting. After analyzing over 1,800 institutions from IPEDS data, they found that due to the changes in tuition discounting criteria within institutions, low-income students were not able to qualify for admissions, which consequently impeded their college access. Additionally, the study strengthened Davis' assertion (2003) by showing that institutional financial aid packages allocated for students from high-income families grew faster than packages for financially needy students (Duggan & Mathews, 2005).

Several studies have demonstrated the somewhat mixed impact of tuition discounting on student access. In 2010, Hillman, employing a logistic regression model, examined the types of students who are more likely to earn tuition discounts. He discovered that, while tuition discounts were more likely to be awarded to low-income students, their discount rates were equal to or lower than the rates for their upper-income peers. Similarly, Reinoehl and Kowalski (2015) found a mixed relationship between tuition discounting and socioeconomic diversity. By analyzing 30 of the largest four-year private non-for-profit institutions, the study discovered that approximately 73.3 percent of institutions in the sample enhanced their socioeconomic diversity, but the mean increase of socioeconomic diversity was approximately only 2.3 percent. Although both studies presented the positive effects of tuition discounting on student composition, their findings also suggested that the effectiveness of tuition discounting as an approach to increasing college access for financially needy students is still questionable.

In fact, scholars have found that a growing number of institutions provide tuition discounts for wealthy students more than for financially needy students (Baum & Lapovsky,

2006; Breneman et al., 2001; Davis, 2003; Doyle, 2010; Duggan & Mathews, 2005; Heller, 2006; Hillman, 2007). Baum and Lapovsky (2006), for example, revealed that lower-priced public colleges and universities allocated a higher proportion of institutional aid for students from middle and higher-income families. Moreover, this study claimed that students with financial need were less likely to attend higher education institutions since both four-year and two-year public institutions gradually provided institutional aid based on a merit or talent-based criterion rather than a need-based criterion (Baum & Lapovsky, 2006). Heller's (2006) study that examined the cross-sectional data from NPSAS also highlighted that wealthy students not only received approximately 30 percent of institutional merit-based aid, but also received 21 percent of need-based aid. Using data from 193 American Association of State Colleges and Universities (AASCU) institutions, Hillman (2007) found similar results. He discovered that AASCU institutions directed a majority of their institutional aid to wealthy students—52% for students without financial need— and argued that these institutions tried to "shape" their student body to meet their institutional preferences.

Race/ethnic Diversity

While several studies have analyzed whether tuition discounting is an effective tool to enhance the higher education access of students from low-income backgrounds, only a few studies have examined the relationship between tuition discounting and the enrollment of underrepresented minority students (Doyle, 2010; Hillman, 2010; Lassila, 2010). For example, Hillman's (2010) research explored which types of students are more likely to receive tuition discounts from public four-year institutions. The study discovered that underrepresented minority, freshmen, and non-resident students were more likely to receive tuition discounts relative to White, upper-level class, and resident students. However, while he found that more

Hispanic students were eligible for tuition discounts than their White peers, the discount rates for Hispanics were smaller than those for White students (12.6 percent and 13.3 percent respectively). Therefore, the findings suggest that tuition discounting plays a somewhat limited role in diversifying student composition within an institution. At the same time, this study also highlighted the need to disaggregate research findings by different underrepresented minority student groups rather than analyze students from diverse underrepresented minority backgrounds as one monolithic group.

Lassila (2010) also investigated whether the effects of institutional tuition discounts differ across different underrepresented minority groups and found that there were significantly positive associations between tuition discounts and the enrollment of Black and Hispanic students after controlling for state environmental and institutional reputation factors. Unlike Hillman's results (2010), this study demonstrated that tuition discounts increase the enrollment of Black and Hispanic students and suggested that such discounts can be a suitable enrollment management strategy for postsecondary institutions that aim to attract students from these racial/ethnic groups. Doyle (2010) also found similar findings, suggesting that Black and Hispanic students were likely to receive more institutional financial aid than their White peers at public four-year doctoral institutions after taking into account other factors in the model. However, the relationships between institutional financial aid and underrepresented minority students were not found to be statistically significant at public four-year non-doctoral institutions.

Overall, studies that examined the relationships between tuition discounting and the enrollment of low-income and underrepresented minority students suggest that this topic merits further attention. This is because the effectiveness of tuition discounts on increasing income or

racial and ethnic diversity is still questionable. Studies that have primarily focused on the enrollment of financially needy students seem to raise concerns about the diminishing higher education opportunities for these students, since colleges and universities have gradually awarded their institutional financial aid to wealthy students rather than to needy students. However, these studies are still limited in that they have mainly used descriptive statistics for their analysis, and they have only examined the effects of tuition discounting on the access of low-income students at postsecondary institutions in general and private institutions in particular. With regard to the enrollment of underrepresented minority students, few studies have examined the association between tuition discounting and such students, thereby limiting our understanding of how tuition discounting has shaped student composition within public colleges and universities over time. Therefore, further studies that examine the differentiated effects of tuition discounting on subgroups of the student population are needed. Additionally, prior studies that have focused on the relationships between tuition discounting and student access and composition mainly conducted student-level analysis, which has prevented higher education researchers and decision-makers from determine unintentional consequences that tuition discounting could have for its student body within postsecondary institutions. Lastly, few studies have explored whether the enrollment of low-income or underrepresented minority students was influenced by need-based or non-need-based tuition discounts.

Tuition Discounting as a Management Tool

In addition to exploring how tuition discounting can influence aggregate enrollment and student composition in higher education institutions, researchers have also examined whether tuition discounts have been effective in increasing institutional revenue and enhancing institutions' selectivity. Although examining the relationships between tuition discounts and

institutional revenue and selectivity are not the primary interests of this dissertation study, prior studies that cover these topics will be briefly described. Overall, these studies suggest that tuition discounts provide financial benefits to institutions to a limited extent and yield rather negative impacts on institutions' budgets. When examining its influence on other budgetary areas, tuition discounting limits institutions' spending on student services and instruction, which may discourage students from enrolling in these institutions.

Impact on Revenue and Other Budget Areas

Few studies have explored whether tuition discounting generates financial benefits to institutions. For instance, Noel-Levitz (2012), an enrollment management consulting firm, conducted research using a sample of 139 private colleges and universities that utilized their services. The study found that its member institutions experienced steady growths in their enrollment and net revenue from freshmen between 2000 to 2011, although the growth in the average overall freshman discount rate was minimal. However, the generalizability of the study's results is questionable since its sample was limited to institutions contracted with Noel-Levitz.

Counter to that study, other research points to the ineffectiveness of tuition discounting as a revenue generating tool. Using IPEDS and NACUBO data, Redd (2000) showed that a substantial portion of four-year private colleges and universities did not gain revenue from tuition discounting. For example, at private institutions with the greatest increases in discount rates, the average cost incurred from providing tuition discounts for a full-time equivalent student was $3,375 while the net revenue gain from tuition was $3,065 per student. Based on these results, the author concluded that some institutions that have implemented tuition discounting practices could face large losses of tuition revenue. Similarly, by examining the various types of private four-year nonprofit postsecondary institutions, Toutkoushian and

Raghav (2021) showed that increases in tuition discount rates led to reductions in excess revenues in general. The study also highlighted that the size of reductions in excess revenues was most significant at research institutions, while masters-level institutions experienced the least reduction in excess revenues. Breneman et al. (2001) also found tuition discounting to have a negative impact on an institution's financial situation. After examining the data from NACUBO and *U.S. News & World Report on America's Best Colleges* survey, the researchers revealed that increases in tuition and enrollment brought about greater expenditures on institutional financial aid, thus offsetting revenue gains. Another study demonstrated the somewhat mixed impact of tuition discounting on institutional revenue, suggesting that institutions can in fact obtain revenue gains through tuition discounts to a limited extent (Hillman, 2012). Using a panel dataset of public four-year colleges from the Delta Cost Project, Hillman presented evidence that tuition discounting can enhance institutions' net tuition revenue. However, he also discovered that the net tuition revenue starts to decrease as the unfunded tuition discounting rates reach beyond 13%.

Some studies have examined the impact of tuition discounting on other budgetary areas (Davis, 2003; Duggan & Mathews, 2005; Hillman, 2010; Redd, 2000). These studies have found that the use of tuition discounting can influence institutional expenditures on instruction and academic support services and can undermine such institutions' financial stability. For instance, Redd (2000) reported that the smallest increase in amounts spent on academics-related services (i.e., libraries, museums, course and curriculum development, and education-related services) were found in institutions that discounted their tuition at higher than average rates. In another study, Davis (2003) asserted that institutions that offer tuition discounting may fail to recruit and retain students if they redirect their funding to finance tuition discounting. Consequently, these

studies have highlighted the unintended financial instability and mission drift that tuition discounting can induce in postsecondary institutions.

Studies on Tuition Discounting from Unrestricted Revenue Sources

Prior studies provide evidence that in both public and private higher education institutions, institutional aid from unrestricted revenue sources (e.g., tuition revenue) has increased. For instance, Hillman (2012) demonstrated that many public four-year colleges and universities have gradually relied on their operational budgets to fund tuition discounts. Similarly, a study from Noel-Levitz (2012) also found that, at private universities that were also the firm's clients, the average aid funded from unrestricted revenue sources increased by approximately $500 between 2010 and 2011.

However, one study explained that the increasing expenditure from unrestricted revenue sources may not be an ideal approach to maximizing total institutional revenue (Martin, 2004). In his paper, Martin demonstrated a policy model of tuition discounting and asserted that a sound financial approach for an institution is to maximize the scholarship discount rate from restricted revenue sources and to minimize the institutional discount rate funded from unrestricted revenue sources. By increasing the former, an institution can be more competitive in increasing access for students with financial needs, in attracting academically qualified students, and in enhancing the institutions' student diversity without degrading instructional quality. Moreover, a decline in the discount rate from unrestricted sources enables the institution to utilize tuition revenue gains on instruction and other student services (Martin, 2004). Hillman's (2012) research at public four-year colleges and universities supports Martin's assertions. After analyzing the effects of tuition discounting on institutional revenue, he found the use of tuition discounts, in particular discounts funded from unrestricted revenue sources, to be a questionable approach to generating

revenue. This study suggests that institutions may encounter diminishing revenue returns to their financial aid investments when discounting rates from unrestricted sources exceed the 13% threshold. Therefore, Hillman argued that institutions need to strategically award tuition discounting by considering their own unique circumstances.

Overall, studies that have examined the impact of tuition discounting on institutional tuition revenue and other budgetary areas have provided mixed or even negative findings. Although differences in study sample size and statistical design explain some of these discrepancies, these studies caution that higher education institutions need to be judicious in utilizing their tuition discounting. This is because, despite some net revenue gains, the cost of aiding students eventually outweighs the financial benefits of enrolling them. They also highlight that institutions can jeopardize their financial stability and reputation, since the redirection of tuition revenue to subsidizing tuition discounts can degrade institutions' ability to provide high-quality instruction as well as academic services to their students. However, future research is necessary, as prior studies have not explored whether the effects of tuition discounting on institutional revenue might differ by institution type or in various state and institutional-level contexts. Therefore, this dissertation research addresses this shortcoming in the tuition discounting literature.

Effects of Tuition Discounting on Institutional Standing

Prior studies have also explored the effect of tuition discounting on improving institutions' academic profile or quality of their student body. For instance, using the College Board's Annual Survey of Colleges data from between 1995 and 1999, Davis (2003) examined the changes in the median SAT verbal test scores of 608 private four-year institutions and 266 public four-year institutions. The study found that along with increases in tuition discount rates

and merit-based aid, about 20 percent of private institutions and 17 percent of public institutions succeeded in increasing their median freshmen SAT verbal scores by 11 points or more, while approximately half of private and public institutions experienced decreases in their median freshman SAT verbal scores (45% for private and 44% for public institutions, respectively).

Similarly, Redd (2000) also found that increases in tuition discount rates did not significantly influence institutions' level of selectivity at private institutions of higher education. By examining the NACUBO survey data of 1,463 private four-year institutions from 1990-91 to 1998-99, the author showed that the median SAT scores of colleges and universities with average and above average tuition discount rates increased by less than 3 percent. On the other hand, both more selective and less selective institutions with below average changes in discount rates experienced the highest average increases in median SAT scores. Consequently, by examining changes in the test scores of admitted freshmen students, both studies provide empirical evidence that increases in tuition discount rates do not significantly influence an institution's academic profile.

Based on different measures for an institution's academic profile, another study also demonstrated the limited impact that tuition discounting has on improving the quality of students (Jalal & Khaksari, 2019). Using IPEDS and the *U.S. News and World Report* annual national university ranking data over the period from 2006 to 2015, the authors discovered that tuition discounting is positively and statistically significantly associated with yield rates in all sample universities. Yet, the study did not find a statistically positive relationship between tuition discount rates and SAT scores. Using institutional ranking as a proxy for institutional reputation, Jalal and Khaksari (2019) also examined how tuition discounting influences an institution's reputation. The authors revealed there to be a statistically negative association

between tuition discounting and institutional rankings for private institutions, but they did not examine this relationship for public institutions.

Based on these studies on this topic, it appears that tuition discounting has not been an effective approach with regards to enhancing institutional standing. The effect of tuition discounting is more explicit at private colleges and universities, although the extent of the influence is not substantial. Yet, future research on this topic is necessary because no prior studies have examined how the effects of tuition discounting practices vary by subsectors of public higher education institutions. Similarly, prior studies have only examined the effects of overall tuition discounts on institutional selectivity, thereby providing a limited understanding of whether the relationship between tuition discounts and institutional selectivity differs substantially by type of tuition discount.

Conceptual Frameworks

There are different ways to think about the topic of tuition discounting. The first approach is to consider the use of tuition discounting from the perspective of colleges and universities. Theories that explain the institutional behavior of implementing tuition discount policies demonstrate why a growing number of colleges and universities choose to do so, and elucidate their use of different types of tuition discounts more specifically. Additionally, these theories also expound upon the reasons that drive many higher education institutions to use tuition discounting practices rather than adopt other strategies that could allow them to achieve their desired institutional goals. By contrast, tuition discounting practices can also be understood from the perspective of students and their families. This framework shows how tuition discounting shapes students' college decisions when colleges and universities offer it to their students. Since this dissertation study focuses primarily on examining the effects of tuition

discounting practices on a variety of student enrollment and composition outcomes, the theories that are presented in this section mainly explain the use of tuition discounting from the perspective of postsecondary institutions. However, for a broader understanding of tuition discounting practices in the realm of higher education, this section also includes theories that explain the effects of tuition discounts from the perspective of students.

This dissertation research draws on four theoretical frameworks to understand the use of tuition discounting practices in postsecondary institutions: (1) the economic concepts of supply, demand, and market competition, which provide a general understanding of why a growing number of postsecondary institutions have utilized tuition discounting practices; (2) the microeconomic theory of non-profit firm behavior, which provides a more nuanced understanding of differences in institutional behaviors with respects to tuition discounting practices; (3) the economic concepts of consumer surplus and price discrimination, which help explain why postsecondary institutions use tuition discounts rather than simply lowering tuition rates; and (4) the notion of cost/benefit analysis, which suggests how financial and non-financial factors can influence the decision to invest in higher education from the perspective of students.

Supply, Demand, and the Competitive Market

The economic concepts of supply, demand, and competitive market are key to understanding the behaviors of individuals and organizations. Supply refers to the quantity of goods or services that producers are willing and able to produce at a given price. All things being equal, as the price of a good increases, the amount of quantity suppliers are willing to produce increases. On the other hand, demand is defined as the quantities of goods and services that consumers are willing and able to purchase at a series of price points. Holding all other factors constant, an increase in the price of goods or services should lead to decreases in the quantity

demanded, and vice versa. When these concepts are applied in the higher education context, colleges and universities can be considered as suppliers, students and their families are demanders, and education is the goods or services that colleges and universities produce (Toutkoushian & Paulsen, 2016). As such, students and their parents make decisions as to whether and where to attend a college at a certain price, whereas postsecondary institutions can decide how many and which students to admit as well as how much tuition and fees to charge for their education services.

It is important to understand that the amount of goods or services that suppliers are willing to produce is related to various factors. Maurice and Smithson (1985) wrote that, with respect to supply, factors such as the price of goods (P_x), changes in price of inputs (F), the prices of complementary and substitute goods and services (P_c and P_s, respectively), expectations about future prices of the good ($P^e_{x,\ t+1}$), and the state of technology (T) influence the quantities that suppliers are willing and able to produce. This relationship can be represented by:

$$Q_{xS} = f(P_x\ ,\ F,\ P_c\ ,\ P_s\ ,\ P^e_{x,t+1},\ T\ ) \tag{2.1}$$

What this implies in the context of higher education is that how many and which students an institution chooses to admit (Q_{xS}) is a function of factors such as the price of the educational service, the price of resources needed to provide services, the state of technology, and any subsidies received by an institution (Toutkoushian & Paulsen, 2016). In other words, depending on the changes in each of these factors, the institution can change the types and the number of students admitted.

Similarly, the amount of goods or services that consumers are willing to purchase is also influenced by various factors. For example, some of determinants that can influence the quantity demanded (Q_{xD}) are the price of goods (P_x), the income levels of consumers (Y), the prices of

complementary and substitute goods and services (P_c and P_s, respectively), expectations about future prices of the good ($P^e_{x,t+1}$), and the tastes and preferences of consumers (*TP*) (Maurice & Smithson, 1985):

$$Q_{xD} = f(P_x, Y, P_c, P_s, P^e_{x,t+1}, TP) \quad (2.2)$$

This suggests that, in the context of higher education, whether and where students ultimately decide to matriculate can be affected by factors such as tuition and fees, the income level of students and their families, the prices of complementary goods (e.g., room and board, textbooks), the prices of substitute goods (e.g., other institutions' tuition and fees), the expected price of future tuition and fees, and students' preferences (DesJardins & Bell, 2006). Together, the foundational concepts of supply and demand suggest that financial factors in the price of college and the price of inputs are critical contributors that shape the decisions of students and postsecondary institutions, and that tuition discounting can be an important practice for both parties.

The notion of competition among suppliers in a market was first introduced by early economists in the 1700s (Cantillon, 1755; Steuart & Skinner, 1767). In *The Wealth of Nations* (Smith, 1776), for instance, Adam Smith contended that suppliers compete with each other based on price, and when an excessive quantity of a good is produced, the market pressures the suppliers to lower their price. Smith and other early economists also observed that prices are inversely proportional to the number of sellers. Based on this work, the notion of a perfectly competitive market, wherein a large number of consumers purchase a standardized product from a large number of suppliers at a given market price was articulated (Cournot, 1838; Hayek, 1948). It is assumed that under this market structure, no competition occurs among sellers since they individually do not have the ability to control market prices. However, beginning in the 19th

century, it became clear that the notion of a perfectly competitive market did not sufficiently describe most actual markets. This is because factors such as the heterogeneity of services or goods, the number of suppliers in a market, and barriers to entry and exit from the market can induce competitions among sellers for consumers (Becker & Toutkoushian, 2013). Therefore, economists became interested in other types of market structures (e.g., monopoly, oligopoly, and monopolistic competition) that help us to understand how suppliers compete with each other for consumers.

Competition among postsecondary institutions can help illuminate the impetus behind the implementation of tuition discounting practices. When competition for students or resources occurs, postsecondary institutions can differentiate themselves from their competitors by changing the prices they charge to students or the quality of education they provide. However, since institutions face scarce resources, they must decide between reducing prices or improving educational services to make the institutions more competitive relative to their peers. The economic principal of demand states that financial factors are crucial determinants in shaping students' decisions regarding whether and where to attend a college, and postsecondary institutions can use their limited operational resources as tuition discounts, with the expectation that the reduced price of higher education will increase the students' likelihood of attending their institution. Therefore, the notion of competition offers some explanation of why higher education institutions award tuition discounts for incoming students.

The economic concepts of supply, demand, and the competitive market suggest that several factors, including the price of college can influence behaviors or decisions of institutions and students and provide an understanding of why institutions engage in tuition discounting practices. Next, the microeconomic theory of a nonprofit firm was elucidated to provide more

nuanced explanations of how higher education institutions, in pursuit of achieving their institutional objectives, decide to implement different types of tuition discounting practices.

Microeconomic Theory of Nonprofit Firm Behavior

The microeconomic theory of nonprofit firm behavior focuses its attention on the decision-making processes of a certain type of organization. Since these organizations have scarce resources, they need to make decisions about how to allocate and use their limited or minimal resources. For them, allocating resources appropriately is crucial since by doing so, they can maximize their utility (e.g., desired goals and missions). Put differently, the optimization of resource allocations is believed to be the key to accomplishing the firms' desired outcomes (Jehle, 2000; Kreps, 1990).

In the context of higher education, although the ultimate goal of colleges and universities is considered to be maximizing knowledge production and distribution (Toutkoushian & Paulsen, 2016), the approaches that the institutions take to achieving this goal may differ by their unique missions and values. The extension of various forms of market structures to the higher education industry can help explaining these differences. Broadly, the higher education industry has a number of separate markets and market structures based on institutional attributes such as homogeneity in education services to students, the geographic span, and student characteristics (Toutkoushian & Paulsen, 2016). For instance, depending on the levels of degree offered, the academic discipline, or even the major, the types and the quality of courses each institution provides can vary (Becker & Toutkoushian, 2013; Toutkoushian & Paulsen, 2016). Similarly, higher education markets can also be defined by factors such as the geographic span over which they exist, and thereby the types of students and resources that colleges and universities pursue

may differ significantly (Toutkoushian & Paulsen, 2016). These concepts imply that institutions in different higher education markets may have distinctive institutional missions and values.

Although the missions and values of postsecondary institutions are heterogenous, there are several utilities or desired outcomes that they generally try to achieve: increasing student enrollment, changing student composition, improving institutional reputation, and revenue generation (i.e., Bowen, 1980; Brewer et al., 2002; Ehrenberg et al., 2006; Hillman, 2012; Hossler, 2006; Hubbell et al., 2002; Lassila, 2010; Redd, 2000). For example, some economists posit that postsecondary institutions seek to maximize their profits or revenue, and thus they try to understand the behaviors of colleges and universities from the perspective of profit-maximization (Rothschild & White, 1995). A number of other studies rely on the assumption that institutions attempt to maximize institutional prestige or reputation (James, 1978, 1990; G. Winston, 1999), asserting that this would attract high-ability students who would then be the key to producing and disseminating knowledge. Some studies also postulate that institutions try to maximize their utility by diversifying their student body, believing that a diverse student composition provides a better educational environment for students (Astin, 1993; Chang, 1999; Milem & Hakuta, 2000).

The microeconomic theory of nonprofit firm behavior in higher education can help us link tuition discounting to the institutions' use of scarce resources and maximization of utility. For example, many colleges and universities may direct their scarce revenue towards tuition discounting to achieve their goal of increasing institutional prestige or shaping the student body. An institution's decision to offer tuition discounts could possibly increase the enrollment of academically well-prepared students, which may enhance their reputation and successfully shape the incoming class according to their interests (Bowen, 1980; Breneman et al., 2001; Brewer et

al., 2002; Redd, 2000). Similarly, colleges and universities can also strategically utilize tuition discounts to diversify their student body. For instance, tuition discounts awarded based on students' financial needs can change historically underrepresented students' enrollment decisions by increasing the likelihood that the latent demand of the institution with financial support will be greater than the latent demands of other higher education institutions (Hubbell, 2002; Redd, 2000). Likewise, by optimally awarding scarce revenue in the form of tuition discounts, colleges and universities can attract the students they desire, which ultimately enables these institutions to maximize their utility.

The microeconomic theory of non-profit firm behavior can also help us understand why institutions emphasize different types of tuition discounting practices. For instance, institutions that try to increase their institutional selectivity may provide non-need-based tuition discounts to non-resident students since the increased enrollment of these students will help the institutions to increase institutional rankings, a goal that they otherwise could not achieve. On the other hand, for institutions that seek to maximize their reputation and prestige, they may discount tuition for low-income and racial or ethnic minority students since such practices can "build or maintain prestige at a national and general level… [by] becom[ing] more and more inclusive" (Brewer et al., 2002). As such, depending on their distinctive objectives, institutions can utilize different tuition discounting strategies strategically to induce their desired outcomes.

Overall, the microeconomic theory of non-profit firm behavior enables us to understand the institutional rationales behind utilizing tuition discounting practices and explain why institutions may offer different types of tuition discounts to students. However, this theory still provides limited insights into why colleges and universities decide to reduce prices in certain instances rather than simply lower tuition to attract students. Instead, the concepts of consumer

surplus and price discrimination must be looked to fully understand an institution's rationale for this practice.

Consumer Surplus and Price Discrimination

Consumer surplus is an economic concept that represents the aggregate benefit that consumers receive by engaging in voluntary trade in the competitive marketplace. It occurs when the price that consumers pay for a product is less than the maximum price that they are willing to pay (Nicholson & Snyder, 2010; Toutkoushian & Paulsen, 2016). When considering consumer surplus in the context of higher education, the total private benefits that students and their families gain from participating in higher education represents the consumer surplus.

It is important to note that consumer surplus is generally associated with consumption. As the law of diminishing marginal utility—that is, that the additional utility derived from an increase in consumption declines with each additional act of consumption—suggests, consumer surplus generally decreases as consumers consume one more unit of a product or service. As such, the price consumers are willing to pay declines as their utility for a good or service falls, resulting in the downward demand curve. Consumer surplus is also related to the price elasticity of the demand. To be more specific, consumer surplus for a product or service becomes zero when the demand for the product or service is perfectly elastic. This is because a change in the price of the product or service can easily shift consumers' demand for it. On the other hand, the inelastic demand of a good or services leads consumer surplus to become infinite since the price of the product or service does not affect the demand for it. In the context of higher education, these aspects of consumer surplus imply that the consumer surplus of students and parents—the total private benefits students and their parents gain from enrolling in a postsecondary institution—are relatively low since the demand for higher education can be easily influenced by

the price of college. In other words, when colleges and universities can reduce the price of a college education, the consumer surplus of students and parents increases, which then leads students to go to college. Consequently, as an approach to capturing the consumer surplus of students and parents, colleges and universities can decide to lower their price through tuition discounts.

For colleges and universities, price discrimination is a reasonable approach to meeting the demand from students and their parents. Defined as the practice of sellers charging different prices to different consumers for the same goods or services, there are three degrees of price discrimination: perfect price discrimination, second-degree price discrimination, and third-degree discrimination (DesJardins & Bell, 2006). Under perfect price discrimination, sellers charge the maximum amount of prices each individual consumer is willing or able to pay. To do so, the sellers should be able to access information about individual consumers, thereby determining the consumers' willingness to pay for goods. In the context of higher education, colleges and universities are not able to engage in perfect price discrimination. Although they are able to access student information, the extent to which the information is available to them is limited. As such, the institutions cannot accurately determine price elasticity for each student. Second-degree price discrimination occurs when the price of goods or services varies by the amount consumers purchase. This concept poorly fits the context of higher education as well. This is because students, in general, purchase a one unit of tuition (i.e., semester, credit) from an institution. Lastly, under third-degree price discrimination, sellers charge different prices based on their consumers' price elasticity. Third-degree tuition discounting is most commonly used by higher education institutions. Rather than charging students an amount equal to their willingness to pay, institutions offer tuition reduction to certain groups of students after considering some

aspects of their information, such as academic ability and financial need. However, it should be assumed that colleges and universities are able to identify different student groups and their price elasticities.

The third-degree price discrimination in addition to consumer surplus in the context of higher education is of particular help in explaining why colleges and universities have been inclined to offer tuition discounts in particular cases rather than reduce tuition and fees for all students. For instance, colleges and universities can lower their tuition and fees, thereby offering a uniform subsidy for all students. In such cases, these institutions may achieve their enrollment goals, since the low price of a college education can increase the consumer surplus of students, which ultimately increase their college demand. However, this is not a cost-efficient approach for the institutions themselves since students who would have matriculated into college without the subsidy can also benefit from the low college price. The institutions could instead utilize the foregone revenue for other institutional purposes such as curriculum development or student services and activities. To reduce unnecessary use of institutional revenue on subsidies, higher education institutions can employ third-degree price discrimination. By awarding different levels of institutional aid based on the price elasticities of different student groups, the institutions can target and attract a specific student population by increasing their consumer surplus while spending relatively less institutional revenue for aid. Consequently, differentiating the sticker price can be a more appealing approach that ultimately increases student demand.

Overall, the concepts of consumer surplus and price discrimination explain why institutions discriminate in college pricing for certain student populations, rather than reduce prices for all students. They suggest that differentiating tuition and fees through tuition discounting enables institutions to use their institutional revenue more efficiently while

effectively capturing the consumer surplus of students and parents. Next, the cost/benefit analysis framework was explained to highlight the importance of financial and non-financial factors on students' college enrollment decisions.

Cost/Benefit Analysis

Economists use the notion of cost/benefit analysis to explain how individuals make decisions about investing in human capital. For instance, Becker (1964) proposed that the amount invested in human capital is a function of the expected return on investment and noted that individuals' decisions regarding how much to invest in their own education depends on factors such as the expected costs and benefits, budget constraints, personal abilities, risks, personal preferences, and the labor market conditions.

When considering this in the context of higher education, students would compare the expected benefits of investing in higher education to the expected costs of obtaining a degree and use this information to determine whether going to college is in their best interest. Here, the expected costs include direct costs (e.g., tuition and fees, room and board), indirect costs (e.g., foregone income), and other non-monetary costs (e.g., years spent in college) while the expected benefits include expected future earnings and time spent until retirement as well as non-monetary benefits such as improved health outcomes due to education (Toutkoushian & Paulsen, 2016). In addition, other non-monetary factors such as personal and family characteristics and preferences also influence students' decisions to invest in higher education. By considering costs and benefits, students should be able to estimate the utility of the net present value of the private benefits arising from investing in higher education, and if it exceeds their threshold value for investing, they pursue a college education.

The application of cost/benefit analysis to college choice models can further explain how individuals decide whether and where to attend a college. Although researchers are divided as to how many stages are in college choice process, most models of student choice group the steps into three broad categories: predisposition, search, and choice (Hossler et al., 1989). During each stage of college choice model, it is assumed that students conduct a cost-benefit analysis and select institutions where the utility of the institutions exceeds the individual's thresholds. When focusing on the choice stage particularly, students will weigh financial benefits such as expected income and socio-economic status after graduation as well as costs including tuition, fees, and foregone income. Consequently, the availability of information about costs and benefits of an institution can substantially affect students' latent demand for the institution and eventually influence their enrollment decisions. However, it is also important to highlight that students can choose an institution based on non-financial factors (e.g., extracurricular activities and professional networking) that best fulfill their expected characteristics (Cabrera et al., 2003; Cabrera & Nasa, 2000).

The notion of cost/benefit analysis helps us understand how higher education institutions can utilize tuition discounts to alter a student's decision to attend a particular college. Although the actual decision is not solely based on students' financial costs and benefits, these are crucial factors that students and their parents take into account. For instance, a central part of the demand model for any good or services is the income or wealth level of the consumer. As the consumer's wealth increases, the likelihood of purchasing the good or service will increase as well. Similarly, the ability to pay for college will also influence a student's decision to "purchase" college education. In this context, the decreased net tuition and fees of an institution

due to tuition discounts will increase students' purchasing power over college education, which will eventually increase students' likelihood to enroll in institutions that provide low tuition.

However, as students' college decisions are not solely determined by financial factors, the impact of tuition discounting on students' enrollment decisions may be limited. For instance, although an institution provides a tuition discount to their potential incoming students, non-price sensitive students (i.e., high- and mid-income students) may decide not to enroll in the institution due to various factors, such as the institution's reputation or distance from home. On the other hand, price sensitive students can be more responsive to tuition discounting since they may prefer to enroll in institutions with lower tuition and fees (Curs, 2008).

Overall, the notion of cost/benefit analysis suggests that students' college demand and choices can be influenced by various pecuniary and non-pecuniary factors. Particularly salient to studying tuition discounting is the notion that the practice can be utilized to achieve institutional goals, although the effects of the practice may be limited by unobserved factors such as students' preferences and institutional reputation.

Summary of Frameworks

As previously highlighted, higher education scholars have focused on examining whether tuition discounting has been an effective strategy to achieve desired institutional outcomes. In fact, as the practice of tuition discounting has become more prevalent in the private higher education sector, these studies mainly used data from private institutions to explore the impact of tuition discounting on institutional outcomes including aggregate enrollment, student body profile, institutional revenue, and institutional standing. Less attention has been paid to the growing popularity of tuition discounting at public higher education institutions.

To explain the underlying rational of why colleges and universities deem tuition discounting to be an effective enrollment management strategy, the researcher employed the economic concepts of supply, demand, and market competition that have bolstered the growing use of tuition discounting practice. These concepts suggest that various factors including the price of educational services and the price of inputs are key influences on the behaviors of students and higher education institutions, and therefore, institutions try to achieve their objectives by offering a reduced sticker price for college through tuition discounts. This phenomenon has also been expanded by the growing competition for students and resources. As mentioned previously, the stagnant growth in numbers of college enrollees and decreased state subsidies for higher education have led higher education institutions to capitalize on tuition and fees as an alternative source of revenue.

The microeconomic theory of nonprofit firm behavior provides a more nuanced explanation of why subsectors of higher education institutions may offer different types of tuition discounts to their incoming students. This framework suggests that the existing differences among postsecondary institutions lead institutions within different higher education markets to have distinctive missions and values, by which they thereby pursue their own desired outcomes (e.g., student enrollment of and access for underrepresented minority students). Consequently, colleges and universities emphasize different tuition discounting practices (e.g., need-based vs. non-need-based) that maximize their utility.

The concepts of consumer surplus and price discrimination, on the other hand, demonstrate the advantage of utilizing price discrimination through tuition discounts over offering uniform subsidies for students. These two ideas suggest that since demands for higher education can be affected by the price of college, colleges and universities choose to offer

differentiated college prices for different groups of populations. The price discrimination approach, accordingly, not only saves on institutional aid expenditures, but also allows higher education institutions to attract a more targeted student population by capturing their consumer surplus.

Lastly, the notion of cost/benefit analysis and its application to the college choice model, which suggest that students make the decision to invest in human capital and enrolling in a particular college by conducting a cost-benefit analysis, explains the use of tuition discounting from the perspective of students. As the economic concept of demand indicates, since students' decisions can be influenced by various factors including the price of college education, tuition discounting can be critical in increasing the latent demand for institutions that offer a discount, which ultimately increases the likelihood of students enrolling in the institution.

Hypotheses

The conceptual framework above has provided the potential reasons that higher education institutions might utilize tuition discounting practices and has explained why tuition discounting may bring heterogenous institutional changes to subgroups of colleges and universities. Based on this conceptual framework and the prior literature on tuition discounting, testable hypotheses are now presented.

Research Question 1

Hypothesis 1

Increase in tuition discounting is associated with an increase in aggregate enrollment. The study hypothesizes a positive relationship between the percentage value of a tuition discount and the aggregate enrollment of higher education institutions. From the conceptual framework of cost/benefit analysis and its application to the college choice model, it can be assumed that

students are more likely to choose an institution that awards a higher tuition discount rate since the reduction in college price increases students' latent demand for the institution compared to other institutions.

Hypothesis 2

Increase in tuition discounting is associated with an increase in the percentage of low-income and underrepresented minority students. Hypothesis 2 assumes a positive relationship between the tuition discount rate and the percentages of underrepresented minority and low-income students. This is because, as the conceptual frameworks of cost/benefit analysis and the college choice model suggest, students' likelihood of enrolling in a particular college is influenced by the price of that college, and students and parents from underrepresented minority and low-income backgrounds are likely to be more price-sensitive relative to their white and affluent peers.

Hypothesis 3

Increase in tuition discounting is associated with an increase in the percentage of non-resident students. With respect to the percentage of non-resident students, a positive relationship between tuition discounting and non-resident students is expected as well. This is because non-resident students are likely to be high-achieving and wealthy, and colleges and universities are likely to award their tuition discounts to these students.

Research Question 1.A

Selectivity

The study expects that the positive relationship hypothesized in **H1** (enrollment) becomes weaker at more selective public institutions compared to less selective institutions. The rationale behind this is that selective institutions already have a larger volume of applicants, which enables

these institutions to achieve their enrollment goals easier than less selective institutions. Similarly, selective institutions also have non-monetary factors that make the institutions more attractive to students and their parents (e.g., academically-related resources, networking opportunities, and reputation). Consequently, the use of tuition discounting at selective institutions may not be as effective as it is at less selective postsecondary institutions. With respect to **H2** (student composition), selective institutions tend to emphasize scores on college entrance exams (Alon, 2009), and underrepresented minority and low-income students are more likely to earn lower scores than affluent, White, and Asian American students (Bastedo & Jaquette, 2001; Posselt et al., 2012). Thus, this study expects the positive relationship between the tuition discounting rate and the percentages of students from underrepresented minority and low-income backgrounds to be less apparent at more selective colleges and universities than at less selective institutions. For the enrollment of non-resident students **(H3)**, it is expected that the positive relationship becomes stronger at more selective institutions than at less selective institutions, since these students tended to be from affluent families and consider both pecuniary and non-pecuniary factors when deciding college.

Research Question 1.B

State Financial Aid Policy

It is hypothesized that state's financial aid policy moderates the hypothesized relationships. With respect to student composition **(H2)**, it is expected that the positive relationship between tuition discounting and the percentages of underrepresented minority and low-income students becomes stronger when states' spending on need-based grants increases. The rationale is that the increases in states' spending on need-based grants help in-state underrepresented minority and low-income students to enroll in in-state public colleges and

universities, thereby bolstering college enrollment of students from underrepresented minority groups and low-SES backgrounds. Regarding the percentage of non-resident students **(H3)**, states' spending on need-based grants weakens the positive relationship between tuition discounting and the percentage of non-resident students. This is because in-state public colleges and universities are more likely to recruit resident students than out-of-state students.

Institutional Financial Health

It is expected that universities in stronger financial and operational positions are more likely to recruit academically well-prepared, affluent, and non-underrepresented minority students because enrollment of these students will enable the institutions to maintain their financial status. Moreover, these institutions usually have relatively higher endowments that can be used to recruit desired students. To that end, the positive relationship between tuition discounting and the percentages of students from underrepresented minority groups and low-income students becomes weakened for financially stable institutions. For the same reason, it is also expected that the positive relationship between tuition discounting and non-resident students becomes stronger at more financially stable institutions.

Research Question 2

The study hypothesizes that the increased share of need-based tuition discounting is associated more with the enrollment of underrepresented minority and low-income students than the enrollment of non-resident students. This is because need-based institutional aid is awarded based on students' financial need, and underrepresented minority and low-income students who are more likely to be from low-SES backgrounds are more likely to qualify for this type of institutional aid. On the other hand, for the enrollment of non-resident students, a negative relationship between the share of need-based institutional grants and the percentage of non-

resident students is expected. This is because non-resident students who tend to be from higher-SES backgrounds are less likely to meet the requirements to receive need-based institutional grants (Jaquette et al, 2016).

Chapter 3

Methods

Data Source

This study examined the effect of tuition discounting practices on public higher education institutions. Specifically, the study investigated the impact of tuition discounting on the institutional outcomes of total enrollment and enrollment by subsets of students, and whether such relationships were amplified or weakened in institutional and state contexts. The data and methodology used to conduct this research are described below.

For the purpose of this study, a panel data was assembled from publicly available sources, such as the U.S. Department of Education's NCES and the Institute for College Access and Success IPEDS database (TICAS). IPEDS is a suitable data for this research because it gathers comprehensive institutional-level data about topics such as financial issues, enrollment, student aid, and institutional revenue and expenditures from higher education institutions that are open to the general public and that participate in any federal financial assistance program authorized by Title IV (Miller & Shedd, 2019). Specifically, the data obtained for this study includes students' race/ethnicity, total enrollment, institutional finances, and student aid. TICAS is another comprehensive dataset that provides various information for more than 13,000 U.S. higher education institutions and their students. Drawing from multiple data sources such as IPEDS, the College Scorecard, the office of Federal Student Aid (FSA), and Peterson's Common Data Set (CDS), this database includes data describing institutional characteristics, student debt, financial aid, cost of attendance, economic diversity, student success, racial diversity, and

enrollment for most academic years between 2000-01 and 2018-19 (College Insight). This study drew upon the TICAS database to form variables from the total amount of need-based and non-need-based institutional grant aid awarded to degree-seeking undergraduates. To control for various state-level and institutional-level factors that may yield inaccurate estimations of the effect of tuition discounting on public higher education institutions and that are related to the outcomes, this study also used data from the National Association of State Student Grant and Aid Programs (NASSGAP), Grapevine, U.S. Census Bureau, and Bureau of Labor Statistics. The analysis period consists of the 11-year period from 2008 to 2018, with each year referring to an academic year. The starting point of the analysis was limited due to changes in IPEDS reporting procedures for some finance-related variables (Jaquette & Parra, 2016) and definitions of race/ethnicity.

The analysis sample began with the 601 public, baccalaureate level and above colleges and universities in the United States, excluding institutions in Alaska, Hawaii, Washington D.C., and U.S. territories. This research only focused on public four-year or above colleges and universities to best estimate how changes within institutions in student enrollment and composition were related to the use of tuition discounting practices at public four-year or above institutions.

Variables

Dependent Variables

Total Enrollment. With respect to overall institutional enrollment, this study chose to look at the enrollment patterns of two groups of students: (1) the total full-time undergraduate student population and (2) first-time, full-time, degree/certificate-seeking undergraduate students. Comparison of the enrollment patterns of the two groups was expected to provide

evidence of whether or not tuition discounting was associated only with the enrollment decisions of first-time freshmen.

Student Composition. For student composition, this study tried to examine the relative effect of tuition discounts on student body composition with respect to race/ethnicity, socioeconomic status, and state residency. To that end, this study generated variables for the percentage of students from underrepresented minority backgrounds (that is, excluding White and Asian students), the percentage of students receiving Pell grants, and the percentage of non-resident students. Each variable was derived from dividing the number of non-White and non-Asian students, Pell-receiving students, and students paying nonresident tuition by the total number of full-time, first-time, degree/certificate-seeking students. It should be noted that this study focused on full-time, first-time undergraduate enrollment rather than total undergraduate enrollment since IPEDS measured the two dependent variables (i.e., the percentages of Pell-receiving students and the percentage of nonresidents) within the group of full-time, first-time students.

Independent Variables

Tuition Discount Rate. The primary independent variable of interest in this study is the tuition discount rate for an institution. Since this variable was not available through IPEDS, the tuition discount rate had to be derived from other existing variables in that database. Prior studies obtained the tuition discount rate of an institution by either dividing the total institutional grant aid by the total gross tuition and revenues from required fees or dividing the average institutional aid per student by the published tuition and fees rate for an institution (e.g., Baum et al., 2010; Baum & Lapovsky, 2006; Browning, 2013; Duggan & Mathews, 2005). Based on this initial approach, the percent of tuition discount for this research was calculated by first adding

institutional grants from restricted and unrestricted resources. The sum of these was then divided by the total revenue generated from tuition and required fees; and the tuition discount rate was multiplied by 100 (Duggan & Mathews, 2005). Since IPEDS' total revenue from tuition and fees excluded the sum of discounts and allowances that are recoded as an offset to the revenues from tuition and fees and auxiliary enterprises, the sum of discounts and allowances was added to the total revenue from tuition and fees. It is important to note that all finance-related variables were adjusted for inflation to represent constant 2018 dollars.

Share of Need-based Institutional Aid. The research question also aimed to explore whether institutional outcomes of interest were influenced by the type of institutional aid awarded to their students. By examining the effect of the share of institutional need-based grants on student outcomes, these results provided implications for whether the shifts in institutional aid from need-based to non-need-based led to meaningful changes in student composition, as colleges and universities expected. The researcher established a variable that represents the share of institutional aid that was need-based using the information available from the TICAS database. This variable was derived from dividing the total amount of institutional need-based grants by the sum of total institutional need-based grants and institutional non-need-based grants. Unlike IPEDS, TICAS defines the total amount for need-based grants as the total amount of institutional grant aid, excluding athletic aid and tuition waivers offered to meet calculated need to degree-seeking undergraduates; the definition of non-need-based grants is the total amount of institutional grant aid, excluding athletic aid and tuition waivers, awarded to degree-seeking undergraduates in excess of calculated need.

Other Covariates

Institution-level covariates. This study identified a series of institution-level and state-level covariates that prior studies and theory suggest may be related to the enrollment of students at colleges and universities. The initial group of variables included those related to college price. For instance, the in-state and out-of-state tuition and fees were included in the models since students' decisions to enroll in college can be influenced by the amount of tuition and fees charged by the institution. This research also included the amount of state/local grant aid, federal student loan aid, and student loan aid received by full-time, first-time students because these variables are measures that affect the net college price paid by students. It should be noted that these variables were adjusted for inflation and represent constant 2018 dollars.

The second group of explanatory variables were intended to account for institutional selectivity. The conceptual framework of the study suggests that more selective institutions may have different capability to recruit and enroll students compared to less selective institutions. Thus, to capture this, selectivity-related variables representing the 75 percentile SAT math score and an institution's acceptance rate were included in the regression models. The math score was chosen as the proxy for institutional selectivity because math is the subject most commonly used by both the SAT and ACT to evaluate students' academic aptitude. For institutions where the majority of students reported ACT scores, these scores were converted using an official correspondence table produced by the College Board (Guide to the 2018 ACT®/SAT® Concordance). An institution's SAT or ACT math 75th percentile score was found to have more missing data than other variables. It is likely that the missing data concerning this variable results from the inclusion of open-admission colleges and universities in the analytic sample. For the primary analyses of this study, the missing information concerning the average 75th percentile

SAT math score was first calculated using the average of nonmissing observations from the previous year and the subsequent year. For other missing values, the average of the 75th percentile SAT score of all institutions was imputed. Sensitivity check excluding estimated values was conducted to test how robust the primary findings were to imperfections in the data.

It is important to highlight that some institutional-level covariates that represent institutional quality and desirability lagged one year behind when examining the relationship of tuition discounting and aggregate enrollment and student diversity. This is because the enrollment decisions of freshmen students were more likely to be influenced by the quality measures of the prior-year than those of the current-year. These variables include college price-related variables, the average 75th percentile SAT math score, and the acceptance rate.

State Characteristics. Prior literature and the study's conceptual framework also suggested that student demand for college can be affected by various states' particular conditions (Hossler et al., 1997; Toutkoushian & Hollis, 1998; Lowry, 2001). For example, prior studies have provided evidence that college enrollment of students is highly associated with the economic conditions of the states in which they reside. Thus, various state-level variables such as the state's unemployment rate and personal income per capita were included in the analyses. The researcher also included the demographic characteristics of states as represented by the percentage of the college-going population from underrepresented minority backgrounds. This was because the demographic trends of minority populations may be related to underrepresented minority student enrollment in states' public higher education institutions.

Moderating Factors

States' Spending on Need-based Grants. The percentage of need-based grants for undergraduate students was the first moderating factor for the study. Drawing from the

NASGGAP and Grapevine data, this study constructed a continuous variable that represents the percentage of need-based grants spent for undergraduate students by dividing each state's spending on need-based grants for undergraduate students by the total amount of state financial assistance for undergraduate students.

Institutional Financial Health. As a proxy for institutional financial health, this study constructed a surplus margin ratio. This variable was calculated by first subtracting the total expenses from the total revenue, then dividing the total net revenue by the total revenue. It is assumed that a higher surplus margin ratio indicates a more financially stable institution. It is important to note that for public colleges, this variable is not perfect because some institutions have separate entities such as for athletics and donations that may not be included in IPEDS.

Statistical Models

Research Question 1

A caveat of the naïve OLS regression model with panel data is that it violates the assumption of independence of each observation in the panel dataset. Since the model does not take into account unit effects that occur due to continuous inclusion of multiple observations from the same unit (i.e., institution) over multiple years, there may be institutional factors that are unobservable to researchers yet correlated with tuition discount rate. To help address this problem, the researcher estimated the following fixed effects regression models of the form:

$$ENROLL_{it} = \alpha + \beta TD_{it} + \delta P_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.1)$$

$$ENROLL_{it} = \alpha + \beta TD_{it} + \delta P_{it} + \gamma S_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.2)$$

$$ENROLL_{it} = \alpha + \beta TD_{it} + \delta P_{it} + \gamma S_{it} + \theta State_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.3)$$

where $ENROLL_{it}$ is the total enrollment at institution *i* in academic year *t*, TD_{it} is a variable representing tuition discount rate with coefficients β, P_{it} is a set of the college price-related

variables with coefficients δ, S_{it} is a set of the institutional selectivity-related variables with coefficients γ, $State_{it}$ is a set of the states' economic and demographic characteristics variables with coefficients θ, $Inst_{i-1}$ represents fixed effects for each institution and Y_t represents a set of fixed effects for each year. Since the fixed effects model eliminates the net effect of observable and unobservable time-invariant characteristics of an institution in the model, it allows the researcher to estimate changes in the relationship between tuition discounting and various institutional outcomes within an institution. For all models, robust standard errors were used to take into account possible heteroscedasticity and to provide more conservative results.

The first equation provided a baseline set of results explaining how college-price variables are associated with student enrollment. Equation (3.2) included controls for institutional selectivity-related measures in the model, thereby more closely accounting for non-price-related factors in student enrollment within institutions. Lastly, equation (3.3) examined whether state-level economic and demographic characteristics contributed to college enrollment at public colleges and universities.

A similar empirical strategy was employed to examine the association between tuition discounting and student composition within institutions:

$$COM_{it} = \alpha + \beta TD_{it} + \delta P_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.4)$$

$$COM_{it} = \alpha + \beta TD_{it} + \delta P_{it} + \gamma S_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.5)$$

$$COM_{it} = \alpha + \beta TD_{it} + \delta P_{it} + \gamma S_{it} + \theta State_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.6)$$

where all variables are defined as before and COM_{it} is each of the variables that represents the percentage of underrepresented minority students, the percentage of low-income students, and the percentage of non-resident students at institution *i* in academic year *t*.

Extending the basic empirical model, this study additionally examined the differential effects of tuition discounting practices on institutional outcomes across subgroups of institutions. Based on prior studies, this research anticipated observing the different effects of tuition discounting on public institutions with varying degree of institutional selectivity.

The study also hypothesized that the associations between the tuition discounting and student enrollment outcomes become stronger or weaker in states with higher spending on need-based grants or in institutions with stronger financial health. To test this hypotheses, the researcher included an interaction between the tuition discount rate and the moderating factors (i.e., state-wide financial aid policy and institutional financial health) in the models. The two-way fixed effect model, for example, is specified as follows:

$$COM_{it} = \alpha + \beta TD_{it} + \omega M_{it} + \tau TD_{it} * M_{it} + \delta P_{it} + \gamma S_{it} + \theta State_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.7)$$

where all variables are defined as before, with the addition of M_{it} representing a moderating factor of either states' spending on need-based grants or institutional financial health with a coefficient ω, and $TD_{it} * M_{it}$ representing an interaction between the tuition discount rate and the moderating factor with the coefficient τ.

Research Question 2

A similar empirical strategy was employed to examine the association between the share of need-based institutional grants and student enrollment and the percentages of underrepresented minority, low-income, and nonresident students, holding the tuition discount rate and other institution- and state-level variables constant. An example of this fixed effect model takes the following form:

$$ENROLL_{it} = \alpha + \beta TD_{it} + \upsilon Share_{it} + \delta P_{it} + \gamma S_{it} + \theta State_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.8)$$

$$COM_{it} = \alpha + \beta TD_{it} + \upsilon Share_{it} + \delta P_{it} + \gamma S_{it} + \theta State_{it} + Inst_{i-1} + Y_t + \varepsilon_{it} \quad (3.9)$$

where all variables are defined as before, and $Share_{it}$ is a variable representing the percentage of need-based institutional grants with coefficients υ.

Sensitivity Checks

In addition to the primary analyses described above, several robustness checks were conducted to test the robustness of the results. Complete results are provided in the Appendix.

Excluding Computed Variables

The main models of this dissertation study included observations that were computed based on the average of the previous year and the subsequent year. As a sensitivity analysis, institutions whose observations had been imputed were excluded.

Institution-level Covariates

For the main models, this research controlled for institution-level control variables that were related to college price and institutional selectivity. However, it could be argued that an institution's finance-related variables may be confounding factors that possibly influence the associations between tuition discounting and student enrollment and student body composition. As such, the sensitivity analysis controlled for finance-related variables including the percentage of institutional revenue from: net tuition and fees; state appropriations; local appropriations; and government grants and contracts in the regression models. The researcher also included the percentage of institutional expenses for research, academic support, and student service.

Institutional Selectivity

When running the main models, institutions were considered more selective if their admissions rate was below 80 percent and less selective if this rate was above 80. Since this was an arbitrary value designed to separate out the two types of public higher education institutions, further tests seemed to be necessary to test the robustness of the results. To that end, this study ran the same regression models while splitting colleges according to admissions rates of 70 and 75 percent, respectively.

Excluding Academic Year

The enrollment in 2010 was dramatically increased because a large number of institutions were deleted due to missing information in variables of the average amount of grants from state/local government received by full-time, first-time, degree/certificate-seeking undergraduate students, the average amount of student loan received full-time, first-time, degree/certificate-seeking undergraduate students, and the average amount of federal loan received by full-time, first-time, degree/certificate-seeking undergraduate students. To examine whether this sudden enrollment peak in 2010 dramatically changed the results of the main regression models, the analysis was repeated excluding the year 2010.

Limitations

Although this study tries to bridge the gaps in the tuition discounting literature, there are several limitations that merit discussion. First, tuition discount rate can only be derived from institutions that report institutional grants from restricted and unrestricted resources and the total gross tuition and required fee revenue. As such, institutions for which tuition discounts rate could not be calculated were not included in the study. In other words, the sample of the study is limited to the institutions whose tuition discount rate could be obtained, and thus, caution is

called for when interpreting and generalizing the results. These limitations in the data also prevented all institutions from being included for each academic year, thus causing an unbalanced panel dataset.

Similarly, TICAS data can also be criticized for its non-representative characteristics. According to TICAS, Peterson's CDS survey instrument asks colleges and universities to voluntarily participate in and answer the survey questions. This implies that certain types of colleges and universities may have incentives to participate in the survey or report their student and institutional information imprecisely. In such cases, it is plausible that the inaccurate data on institutional financial aid may lead to misleading interpretations of the relationship between tuition discounting and institutional characteristics. TICAS data is also limited in providing information about all participating institutions since some data from these institutions are missing, for various reasons (TICAS, 2020). For example, TICAS explains that the data may be missing if some institutions decide not to answer survey questions or if some surveys are not designed to be responded to by certain types of institutions. Given that the possibility of systemic patterns in missing information for institutional aid variables may influence the results, researchers using this dataset should examine the patterns of missing cases and make adjustments for the dataset accordingly.

The last issue involves using the correct information at the appropriate time during the analysis. It is important to highlight that students will not be able to obtain exact information about the college price and the amount of student aid they will receive from a given college and outside sources until they make a college decision. Consequently, students will likely use prior year values when making enrollment decisions. To that end, this study lagged behind college prices and financial aid related, and institutional selectivity-related variables by a year.

Chapter 4

Results

This chapter presents the results of the analyses based on the methodology described in chapter 3. The analyses included public baccalaureate level and above institutions in the United States, excluding institutions in Alaska, Hawaii, Washington D.C., and U.S. territories.

Overall, this research found no statistically significant relationships between the tuition discount rate and the enrollment of both full-time undergraduate and full-time, first-time students for some regression models. With regards to student composition, the results show that the percentage of underrepresented minority students was not significantly related to tuition discount rate. However, when the same analysis was repeated for each group of underrepresented minority students (i.e., Black, Hispanic, Asian, and others), a negative association between the tuition discount rate and the percentage of Black students emerged, whereas a positive relationship was observed for the percentage of Hispanic students. The results also suggest that the percentage of low-income students was positively associated with the tuition discount rate across models, and this held especially true for selective public institutions. It was also found that the tuition discount rate was not a significant predictor of the percentage of non-resident students. Lastly, it is important to highlight that the degree to which tuition discounts impacted student composition was moderated by institutional selectivity and states' spending on need-based grants, while the moderating effect of institutions' financial health was marginal.

This chapter is organized as follows: first, it discusses the descriptive statistics of the variables included in the analysis and the trends of each outcome variable over time. Then, it presents the results of the analysis of the data related to the main research hypotheses.

Research Question 1: Student Enrollment and Composition

As discussed in Chapter 3, this study explores several outcome variables that represent student enrollment: full-time freshmen enrollment, full-time undergraduate enrollment, the percentage of underrepresented minority students, the percentage of low-income students, and the percentage of non-resident students. Although the results of each of the outcome variables only show a limited understanding of the effect of tuition discounts on enrollment and student composition, it is expected that the results all together will present a more comprehensive view of changes in study body composition that tuition discounting can bring to institutions.

As mentioned in the previous chapter, institution-level measures that represent institutional desirability included in this analysis were lagged by one year since enrollment decisions by students are more likely to be related to the previous year's institutional measures. To that end, the total number of sample institutions included in this analysis was 601 public four-year colleges and universities over 11 years.

Descriptive Statistics

Table 4.1 contains the descriptive statistics of the dependent variables and the independent variables of interest that were used for the analysis of student enrollment and student composition for the year 2016. There were 581 public four-year colleges and universities in the sample in this particular year. On average, the discount rate for public institutions was approximately 16.30% in 2016. It is important to highlight that the magnitude of tuition discount rate differed substantially across institutions. More selective institutions, for instance, awarded

approximately 17.75% of tuition discounts to their students over the entire analysis period, whereas the average tuition discount rate was approximately 14.81% for less selective institutions in the year 2016.

---------- Insert Table 4.1 Here ----------

When examining the changes in tuition discounts across analysis years, overall, tuition discount rate gradually increased. The discount rate of more selective and less selective institutions exhibits similar trends, with less selective institutions awarding a relatively lower tuition discount rate than more selective institutions to their students (see Figure 4.1 and Table 4.2).

---------- Insert Figure 4.1 Here ----------

---------- Insert Table 4.2 Here ----------

The distribution of the change in tuition discount rate from 2008 to 2018 is presented in Figure 4.2. For example, the institution in the 50th percentile of the tuition discount rate growth chart experienced changes in the tuition discount rate of 3.97%, whereas the institution in the 75th percentile experienced a change of 9.35%. It should be noted that, although tuition discount rate increased on average between 2008 and 2018, some colleges and universities decreased their discount rate during the same period.

---------- Insert Figure 4.2 Here ----------

When examining the average rate of tuition discounts by type (i.e., need-based or non-need-based tuition discount), on average, institutions provided 6.64% tuition discounts for need and 4.68% for non-need-based reasons in 2016 (See Figures 4.3 and 4.4)[1]. Similar to the overall

[1] It should be noted that the sum of need-based and non-need-based tuition discount rates are not equal to the overall tuition discount rate demonstrated in Figure 4.2. This is because need-based and non-need-based tuition discount rates were calculated using the data obtained from TICAS database, while the overall tuition discount rate was derived from the data obtained from IPEDS.

trends in tuition discounts, need-based tuition discounts continued to increase over the analysis period with more selective colleges and universities providing higher discounts than less selective institutions. Non-need-based tuition discounts remained relatively stagnant yet still fluctuated somewhat.

---------- Insert Figure 4.3 Here ----------

---------- Insert Figure 4.4 Here ----------

Between 2008 and 2011, the discount rate for both all sample and more selective institutions decreased and began to increase again afterwards. However, except for a sudden peak and subsequent decrease in 2011 and 2012, the discount rate for less selective institutions minimally yet gradually increased. In general, the discount rate for less selective institutions were relatively higher than those for more selective institutions.

With regard to student enrollment, the average number of full-time undergraduate students was approximately 8495, and the average number of full-time freshmen students was 1841 for all institutions in 2016. Table 4.2 presents the changes across time for the average number of full-time freshmen enrollment and the average number of full-time undergraduate students. The results suggest that the number of full-time undergraduate students and the number of full-time freshmen students generally increased between 2008 and 2018, except for a dramatic increase in 2010. As mentioned previously, the sudden enrollment peak in 2010 was resulted from changes in sample institutions.

Among the full-time freshmen students, approximately 39.82% of students were identified as underrepresented minority students. In addition, the mean percentage of low-income students among the full-time freshmen was about 42.69%, while 14.13% of the full-time freshmen students were found to be non-resident students for the year 2016. When exploring the

changes in the average percentage of underrepresented minority students over time, the shares of underrepresented minority students steadily increased for both the full sample and the subsamples of institutions (See Figure 4.5). Specifically, a higher share of underrepresented minority students was observed at more selective institutions than at less-selective institution. With respect to the average percentage of Pell recipients, it substantially increased between 2008 and 2010 for all sample institutions but became relatively stagnant afterwards. The substantial increase in the enrollment of Pell recipients can be explained by the expansion of the Pell grant program under the Obama administration. It is also important to note that the percentage of Pell-receiving freshmen students was lower for more selective institutions than for less selective institutions (See Figure 4.6). Lastly, the average percentage of non-resident students was found to be stagnant over the analysis period, except a sudden peak in 2010 for less selective institutions (See Figure 4.7).

---------- Insert Figure 4.5 Here ----------

---------- Insert Figure 4.6 Here ----------

---------- Insert Figure 4.7 Here ----------

Regression Results

Enrollment. Tables 4.3 and 4.4 present the estimated relationship between tuition discount rate and full-time undergraduate enrollment and full-time freshmen enrollment. The first column in each table shows the results for the fixed effects regression model that control for college price-related variables. The second column added variables for institutional selectivity measures to the models. The third column included the variables that account for states' economic conditions and demographic trends.

The analysis was repeated for more selective and less selective colleges and universities separately to determine whether the relationship between tuition discount rate and student enrollment was driven by a particular subsample of institutions. The fourth column in Tables 4.3 and 4.4 presents the results of full-time student enrollment at selective colleges, and the last column shows the results of non-selective institutions.

---------- Insert Table 4.3 Here ----------

---------- Insert Table 4.4 Here ----------

Consistent with H1, the results show that the tuition discount rate was positively associated with the enrollment of full-time undergraduate students. However, the relationships were only statistically significant for the first two models, and no statistically significant associations were found for the other models. Similarly, when examining the relationship by institutional selectivity, the tuition discount rate was not a significant predictor of the enrollment of full-time undergraduate and full-time, first-time undergraduate students.

Although other institution and state-level characteristics were not the primary interest of this dissertation study, the results of several of these control variables are noteworthy. Looking across the models, it can be seen that in-state tuition and fees was a significantly positive predictor of student enrollment in general, whereas positive relationships were found between student enrollment and out-of-state tuition. Regarding the variables that represent financial aid, student loans received by full-time freshmen were positively associated with full-time freshmen enrollment in general. Not surprisingly, the institutional selectivity measure of the 75th percentile SAT math score was positively associated with the enrollment of full-time undergraduate students for full sample institutions and more selective institutions, while no significant association was observed for less selective colleges. Instead, the unavailability of 75th percentile

SAT math scores was a positive predictor of full-time student enrollment at less selective institutions. Lastly, the acceptance rate was not a statistically significant predictor of the full-time undergraduate and full-time freshmen enrollment across the models.

With regard to state-level characteristics, the variables that represented states' economic conditions (i.e., personal income per capita and unemployment rate) were also found to be associated with the full-time undergraduate and full-time freshmen undergraduate enrollment in general. Specifically, personal income per capita was positively related to student enrollment for all sample institutions and more selective institutions, in particular. On the other hand, a negative association was found between the unemployment rate and student enrollment at all sample and selective institutions. Regarding state demographics, specifically the percentage of Hispanic students among the college-aged population was a positive predictor of undergraduate enrollment at all sample institutions and selective institutions in particular.

Underrepresented Minority Enrollment. Table 4.5 shows the results of the fixed-effects regression models examining the relationship between tuition discount rate and the percentage of underrepresented minority student population. The first three columns summarize the results of the fixed effects models for all sample institutions. The last two columns present the results of the fixed effects model (Model 3) for more selective and less selective institutions separately. The variables included in each model were the same with the aforementioned models for full-time student enrollment.

---------- Insert Table 4.5 Here ----------

Consistent with the hypothesis, the results suggest that there were positive associations between tuition discount rate and the percentage of underrepresented minority students, although the relationships were not statistically significant across the models. When examining the

relationship between tuition discount rate and the percentage of each underrepresented minority student group, some statistically significant relationships emerged. Table 4.6 shows that the percentages of Black and Hispanic student groups were statistically significantly related to tuition discount rate. Specifically, an additional percent increase in tuition discount rate was associated with a 0.045% decrease in Black student enrollment, while the same percent increase in discount rate was related to a 0.052% increase in the percentage of the Hispanic student population within institutions. Although statistically significant, the practical significance of this finding seems modest. To place these findings into context, for example, the average rate of tuition discounts increased from 14.318% to 17.936% between 2008 and 2018. Thus, the model suggests that a 2.936% increase in discount rate was associated with a 0.132% (i.e., -0.045*2.936) decrease in Black student enrollment. For the Hispanic students, on the other hand, the same percent increase in tuition discount rate was associated with 0.153% (i.e., 0.052*2.936) increase in Hispanic student enrollment. Overall, these results can possibly suggest that the decrease in the enrollment of Black students may be offset by the enrollment of Hispanic students within institutions.

---------- Insert Table 4.6 Here ----------

This study's hypothesis also predicted that states' spending on need-based grants and institutions' financial conditions can moderate the positive relationship between tuition discount rate and the underrepresented minority enrollment (see Table 4.7). This hypothesis was tested including the interaction term of tuition discount rate and the moderating factors in the base fixed-effects model.

---------- Insert Table 4.7 Here ----------

The results show that the positive relationship between tuition discount rate and the underrepresented minority student enrollment strengthened as states' spending on need-based grants increased. For instance, when the level of states' spending on need-based grants was at the minimum percentage (i.e., zero), an additional percent increase in tuition discount rate was associated with a 0.102% decrease in the underrepresented minority student enrollment. However, at the maximum level of need-based grants spending of 21.862%, a one percent increase in discount rate was associated with a 0.206% (i.e., -0.102 + (21.862*0.014)) increase in the percentage of underrepresented minority students. The results also suggest that the moderating effect of states' spending on need-based grants was stronger for less selective colleges and universities than for more selective institutions, as indicated by different levels of spread of estimated associations across states' spending on need-based grants. With respect to the institutional financial health, the results revealed that it did not moderate the relationship between tuition discount rate and the percentage of underrepresented minority students across the samples of public colleges and universities.

Looking across the models, several institution-level covariates had noteworthy relationships with the percentage of underrepresented minority students. With respect to the college-price related measures, in-state tuition and fees was a significant predictor of the percentage of underrepresented minority students in general. The average amount of grants from state and local government full-time freshmen received and the average amount of federal grants full-time freshmen received were positively associated with the percentage of students from underrepresented minority backgrounds, while the average student loan amount received by full-time freshmen had a negative association with the enrollment of underrepresented minority students. With respect to variables that represent institutions' selectivity, the 75th percentile SAT

math score was negatively related to the percentage of underrepresented minorities for all sample institutions and the subsample of more selective institutions. Similarly, a statistically negative association was found between the acceptance rate and the percentage of underrepresented minority students in the full sample of institutions and at more selective institutions.

When considering the state-level covariates, the unemployment rate had a negative association with underrepresented minority enrollment, and negative relationships were also observed for the poverty rate. Lastly, with regard to states' demographic characteristics, the results suggest that the percentage of the college-aged Hispanic population was positively associated with the percentage of underrepresented minority students across the models, while a weak negative association was found between underrepresented minority enrollment and the percentage of the college-aged Black population for more selective institutions.

Low-income Student Enrollment. Table 4.8 shows the results of the regression models explaining the relationship between tuition discount rate and the percentage of low-income students within institutions. As mentioned previously, the first three columns present the results of the fixed-effects models with different institution-level and state-level control variables for all sample institutions. The full regression model (Model 3) was also repeated for the subsamples of more selective and less selective institutions and the results are presented in the last two columns in Table 4.9.

---------- Insert Table 4.8 Here ----------

This research hypothesized that tuition discount rate has a positive association with the percentage of low-income students (H2). Consistent with this hypothesis, the findings suggest that tuition discount rate was positively related to the percentage of low-income students, although the magnitude of the coefficients slightly decreased as more control variables were

included in the models. For instance, the results of the third model suggest that as tuition discount rate increases by each additional percentage point, the percentage of Pell grant recipients increases by approximately 0.077 %. To put this result into context, the model predicts that a 2.936% (i.e., the increase in average of tuition discount rate between 2008 and 2018) increase in tuition discounts was associated with a 0.226% increase in the percentage of Pell grant recipients. Although the practical significance of this relationship was modest, its significance increased for institutions that experienced larger changes in its tuition discounts. For instance, for the institution in the 75th percentile for tuition discount rate growth from 2008 to 2018, its discount rate increased from 3.216% to 12.564%. This result suggests that a percent change in tuition discount rate of 9.348% was associated with a 0.719% increase in the percentage of Pell grant recipients. It is also important to note that the magnitude of the positive relationship was stronger at more selective institutions. Specifically, the coefficient estimate for more selective institutions was 0.127, whereas the coefficient estimate for less selective institutions was not significantly higher than 0 and not statistically significant.

Similar to the dependent variable of the racial/ethnic minority enrollment, whether the moderating factors of states' spending on need-based grants and institutions' financial health strengthened or weakened the relationship between tuition discount rate and the percentage of low-income students was also tested by modeling an interaction between the moderators and tuition discount rate (see Table 4.9).

---------- Insert Table 4.9 Here ----------

Overall, the results reveal that the positive association between tuition discount rate and the percentage of low-income students became stronger as states' spending on need-based grants increased. For example, when states' spending on need-based grants was at the minimum level

(i.e., zero), an additional percent increase in tuition discounts was associated with a 0.001% increase in the percentage of Pell-grant recipients. However, when the states' spending on need-based grants was at the maximum level of 21.862%, an additional percent increase in tuition discount rate led to a 0.239% increase in the percentage of low-income students. State spending on need-based grants also strengthened the positive association between tuition discount rate and the percentage of Pell recipients for less selective institutions. As the spreads of estimated associations across states' spending on need-based grants suggest, the moderating effect of states' need-based grants was similar across the full sample of institutions and for the less selective institutions as well.

Regarding institutional financial health, this study found no statistically significant moderating effect of an institution's surplus margin ratio on the relationship between tuition discount rate and the percentage of Pell-recipients.

With respect to institution-level and state-level covariates, some of the results merit discussion. Neither in-state nor out-of-state tuition and fees were statistically significant predictors of the share of low-income students enrolled in public four-year institutions in general. The results also suggest that the average student loan amount received by full-time freshmen students was negatively significantly related to the percentage of low-income students across the full sample and in more selective institutions. Regarding institutions' selectivity measures, the 75th percentile SAT math score was negatively associated with the percentage of low-income studens, whereas the availability of 75th percentile SAT math scores and the acceptance rate were found to be positive predictors of low-income student enrollment across the models. It is also important to highlight that both of the SAT measures were more prominent predictors of the percentage of low-income students for more selective institutions than for non-selective

institutions, while the magnitude of the coefficient for the acceptance rate was larger for less selective institutions.

With regard to state-level covariates, the results show that the unemployment rate was negatively associated with the share of low-income students at public four-year institutions, and less selective institutions in particular, while the poverty rate was a negative predictor of low-income student percentage. Considering the variables that represent states' demographic trends, the percentage of the college-aged population who were identified as Black was a negative predictor of the share of low-income students for all sample institutions.

Non-resident Student Enrollment. Table 4.10 presents the results of the analysis that examined whether tuition discount rate was positively related to the percentage of non-resident students. The format of the table is consistent with the ones above.

Consistent with the hypothesis, positive associations between tuition discount rate and the percentage of non-resident students were observed across the models, although coefficient estimates were not statistically significant.

---------- Insert Table 4.10 Here ----------

Similar to other student composition variables, this research also explored whether the positive relationship between tuition discount rate and the percentage of nonresident was influenced by the moderating factors of states' spending on need-based grants and institutions' financial health. An interaction between the moderators and tuition discount rate variable was added in the base models to test the hypothesis.

As predicted by the conceptual framework, the positive relationship between tuition discount rate and the percentage of non-resident students became weaker as states' spending on need-based grant increased (see Table 4.11). For example, at the minimum percentage of states'

spending on need-based grants (i.e., zero), a one percent increase in tuition discounts was associated with a 0.108% increase the percentage of non-resident students. On the other hand, an additional percent increase in tuition discount rate was associated with a 0.154% decrease in the share of non-resident students at the maximum percentage of states' spending on need-based grants, 21.862%. The results also suggest that the statistically significant moderating effect of states' spending on need-based grants was primarily found in less selective institutions, and its effect was stronger for less selective institutions than more selective institutions. With regard to the moderating effect of institutional financial health, institutions' financial conditions weakened the positive relationship between tuition discount rate and the percentage of non-resident students for less selective colleges and universities. According to the results, at the minimum level of surplus margin ratio (i.e., -0.862), an additional percent increase in tuition discount rate was associated with a 0.328% increase in the percentage of non-resident students. Contrarily, at the maximum level of surplus margin ratio (i.e., 0.68), a one percent increase in tuition discount rate was associated with a 0.112% decrease in the share of non-resident students among full-time, first-time undergraduates. However, no significant moderating effect of institutional financial health was observed across the full sample or in the subsample of more selective colleges and universities.

---------- Insert Table 4.11 Here ----------

Lastly, several institution-level covariates had statistically significant associations with the percentage of non-resident students. According to the results, the variables representing college price, including out-of-state tuition and fees, and the average student loan amount received by full-time, first-time undergraduates were positively related to the percentage of non-resident students for the full sample and in more selective institutions, while the average

federal loan amount received by freshmen students was a negative predictor of the percentage of non-resident students across the models. Considering these institutional selectivity measures, the 75th percentile SAT math score was not statistically associated with the share of non-residents students. However, the availability of the 75th SAT percentile math scores and the acceptance rate were found to be negative predictors of the percentage of non-resident students in general.

For state-level covariates, the measures that represent states' economic conditions were not significantly related to the percentage of non-resident students in general. With regards to variables that represent states' demographic trends, the percentage of the college-aged population of Hispanic background was positively associated with the share of non-resident students enrolled for all sample institutions and selective public four-year colleges and universities.

Research Question 2: Share of Need-based Institutional Grants

In addition to examining the relationship between tuition discount rate and student enrollment and study body composition, this study also explored whether the changes in institutions' emphasis on need-based institutional grants over non-need-based grants influenced student enrollment outcomes, holding the tuition discount rate and other institution- and state-level variables constant. As mentioned in the previous chapter, since the variables of institutional need-based grants and non-need-based grants were available through TICAS database, only institutions that provided this information were included in the analysis. Thus, there were 395 public four-year colleges and universities in the sample in this analysis.

Descriptive Statistics

Table 4.12 contains descriptive statistics of the dependent variables and the independent variables of interest that were used for the analysis of student enrollment and student composition for the year 2014. On average, institutions awarded approximately tuition discounts

of 16.36% to their students in 2014. With regard to the share of institutional grants that were awarded based on students' financial need, approximately 56% of institutional grants were awarded based on students' financial need for all sample institutions in 2014. When examining the trend of the share of need-based institutional grants across the analysis period, the average of the share of need-based institutional grants gradually increased between 2008 and 2010 and became relatively stagnant afterwards for all sample institutions. The trend of more selective institutions followed the one for all sample institutions, while the share of need-based institutional grants remained relatively constant between 2008 and 2010 and suddenly increased in 2011 for less selective institutions. Overall, more selective institutions provided a higher share of institutional grants than did less-selective institutions across the years (see Figure 4.8).

---------- Insert Table 4.12 Here ----------

---------- Insert Figure 4.8 Here ----------

Regression Analysis

Table 4.13 and 4.14 present the results of the regression models that included the variable of the share of institutional aid based on students' financial need. Similar to the tables above, the first three columns present the results of the fixed-effects models with different levels of institutional and state covariates for the full sample institutions. The last two columns provide the findings for the subsamples for more selective and less selective institutions.

---------- Insert Table 4.13 Here ----------

---------- Insert Table 4.14 Here ----------

The results reveal that there were positive associations between the share of need-based institutional grants and the enrollment of full-time undergraduate students across the full sample of institutions, and negative associations were observed for the subsamples of more selective and

less selective institutions, holding the tuition discount rate and other institution and state-level variables constant. However, the coefficient estimates were not statistically significant. For the full-time freshmen enrollments, the share of need-based institutional grants was negatively related to the enrollment of full-time freshmen and not statistically significant in general (See Table 4.14). Similar to the results of the primary analysis, the enrollment of full-time undergraduate students was positively associated with tuition discounts and not statistically significant for the full sample of institutions. However, the sign of the coefficients changed for the subsample of less selective institutions, but this was not statistically significant. For the full-time, first-time student enrollment, the sign of coefficients also changed from positive to negative and the coefficients were not statistically significant.

With respect to the relationship between the share of need-based institutional grants and the percentage of underrepresented minority students, it was not surprising to find that the share of institutional aid based on students' financial needs was positively associated with the percentage of underrepresented minority students, when accounting for the tuition discount rate and other institution and state-level variables constant (Table 4.15). According to the results, an additional institutional aid awarded based on students' financial need would likely increase the percentage of underrepresented minorities within institutions by approximately two percent. The results also show that the magnitude of the positive relationship between the percentage of underrepresented minority students and the share of institutional aid based on financial need was much stronger for the less selective institutions than for the full sample of institutions. Specifically, for the sample of less selective colleges, the coefficient estimate for the share of institutional need-based grants was 2.548. When placing the results in context, the share of institutional need-based grants for the less selective institutions increased from 49.40% to

54.40% between 2008 and 2018. Thus, the results indicate that a percent change in the share of institutional need-based grants of 5 percent was associated with a 12.74% increase in the percentage of underrepresented minority students for the less selective institutions. Consistent with the results of the primary analysis, tuition discount rate had positive associations with the percentage of underrepresented minority students, although the estimated coefficients were not statistically significant across the models.

---------- Insert Table 4.15 Here ----------

Table 4.16 presents the results of the relationship between the share of institutional need-based grants and the percentage of Pell grant recipients. The percentage of Pell grant recipients was positively associated with the share of institutional grants based on students' needs in general, although the estimated coefficients were statistically significant only for the subsample of the more selective institutions. Specifically, the results suggest that an additional increase in the share of need-based institutional grants was associated with a 2.052% increase in the percentage of Pell-receiving students at the more selective institutions. With respect to the relationships between tuition discount rate and the percentage of Pell recipients, findings indicate that the tuition discount rate was a positive predictor of the share of Pell-receiving students for the full sample and the subsample of selective institutions.

---------- Insert Table 4.16 Here ----------

Lastly, no statistically significant associations were observed between the share of need-based institutional grants and non-resident students across the models (See Table 4.17).

---------- Insert Table 4.17 Here ----------

Sensitivity Checks

A variety of robustness checks were conducted to test the sensitivity of the study's results. First, the researcher ran models that tested the robustness of the primary analysis that used computed observations by excluding them. Second, institutional finance-related measures were included to rule out the possibility of institutional finance-related measures as confounding factor in the relationship between tuition discounting and student enrollment and diversity outcomes. Third, the same regression models were conducted with different levels of selectivity (i.e., admission rates of 70 percent and 75 percent) to test the robustness of the primary results. Lastly, the researcher ran regression models excluding the year 2010 to eliminate the possible influence of the sudden enrollment peak that occurred that year. All the results are presented in Appendices section.

Excluding Computed Observations

One challenge in estimating the relationships between tuition discount rate and total enrollment and enrollment by subsets of students was missing observations. For the primary analysis, the missing observations were computed using the average of the previous year and the subsequent year, which enabled the researcher to utilize information from as many colleges and universities as possible. To test the robustness of the results the primary analysis, this study excluded these computed observations and ran the same regression models. In general, the findings of the sensitivity checks were not significantly different from the results of the primary analysis (See Appendix B).

Including Institutional Finance-related Variables

To test the possibility of the confounding effect of institutions' finance-related variables, variables that represent the percentage of revenue and expenditures from a variety of categories

were included. The findings related to the percentage of underrepresented minorities, the percentage of low-income students, and the percentage of non-resident students were robust across the models in general. However, for full-time student enrollment, the coefficient estimates for all sample institutions became statistically significant across the models. The sign of the coefficients stayed consistent, although its magnitude increased slightly. Overall, the results of the sensitivity check suggest the robustness of the initial findings (See Appendix C).

Different Selectivity Levels

For the primary analysis, the researcher explored whether the relationship between tuition discount rate and student enrollment and composition differed across institutions with different institutional selectivity. The acceptance rate was arbitrarily set at 80 percent to separate out institutions as either more selective or less selective institutions. To test the robustness of the results to the different levels of institutional selectivity, models with the acceptance rates of 70 percent and 75 percent were also conducted. In general, although the sign of some of the estimated coefficients for the full-time, first-time enrollment and the percentage of underrepresented minority students changed, these were not statistically significant. For the percentage of non-resident students, however, the estimated coefficients for the less selective institutions became statistically significant at the 0.1 level, with both the 70 percent and 75 pecent acceptance rates. Lastly, the results of the percentage of low-income students were consistent compared to the results of the primary analysis (Appendix D).

Excluding Academic Year 2010

When examining the relationships between tuition discount rate and full-time undergraduate and freshmen enrollment, one concern that arose was the possibility that the abrupt increase in enrollment in 2010 may bias the relationships. The average of enrollment in

2010 dramatically increased because some institutions were removed due to the missing observations in the average amount of grants from state and local governments received by full-time, first-time students, and the average amount of private loan and federal loan received by full-time, first-time students. To examine whether the sudden increase in student enrollment in 2010 influences the results of the primary analysis, this study excluded the academic year 2010 and ran the same regression models. The results suggest that the findings are robust to removing the academic year 2010 (Appendix E).

Chapter 5

Discussion and Conclusion

As a growing number of colleges and universities have begun to award tuition discounts to their students, higher education researchers have become increasingly interested in exploring the effects that tuition discounts can have on colleges and universities. Particular attention has been paid to examining whether tuition discounts have provided the meaningful enrollment and student body composition changes that colleges and universities expected. Although the invaluable findings of these studies have opened the door to discussions about the effectiveness of tuition discounting practices on enhancing student enrollment and student composition, they are still limited to some extent. First, many of these studies restricted their sample institutions to private colleges and universities. Second, these studies often overlooked the possibility that the effects of tuition discounting on student enrollment may vary by institution and state-level characteristics. Third, few studies differentiated institutional grants by type (i.e., need-based and non-need based), thereby limiting our understanding of whether the use of these types of institutional grants may result in different institutional outcomes. Fourth, no prior studies tested whether institution- and state-level conditions moderate the relationships between tuition discounting and student enrollment and student body composition.

The conceptual framework that informed this dissertation suggested that understanding the use of tuition discounting and its effects on various institutional outcomes requires the consideration of each institution's distinctive missions and values as well as varying levels of access to financial and non-financial resources across institutions. This is because an institutions' decision to offer a particular type of tuition discount to specifically targeted student

populations may be influenced by the contexts of institutions' internal as well as external missions and conditions, and this can lead these institutions to obtain different institutional outcomes.

Based on this conceptual framework, this dissertation research explored the tuition discounting effect heterogeneity across subsectors of public higher education institutions with respect to student enrollment and student composition. The study also examined whether the institution-level and state-level contexts (i.e., state spending on need-based grants and an institution's financial health) moderated the association between tuition discounting and institutional outcomes, thereby allowing for a determination of how the effects of tuition discounting differ across institutions with different institutional and state characteristics. Lastly, by collecting data from a variety of sources including IPEDS and TICAS, the study was also able to separate need-based and non-need-based institutional grants and examine whether the different level of emphasis on a particular type of institutional grant could impact student enrollment and composition at public four-year postsecondary institutions differently. This exploration, thus, showed the aftermaths of the shifts in awarding institutional grants based on students' financial need rather than on non-financial factors.

Summary of Results

The results of this study show that tuition discount rate was associated with little change in undergraduate student enrollment at public colleges and universities. With respect to changes in students' racial/ethnic composition, tuition discount rate was not an effective approach to increasing the overall percentage of underrepresented minorities within public universities. Interestingly, when examining the associations between tuition discount rate and the percentage of each underrepresented minority group, increased discount rate was positively related to the

percentage of Hispanic students. The same increases were, however, associated with negative outcomes for Black students. Overall, these findings were quite surprising, because it was expected that underrepresented minority students, who are often price-sensitive, would change their enrollment decisions as a result of receiving tuition discounts. Perhaps what these results imply is that even if the discounts influence the enrollment of Black and Hispanic students, the enrollment of one group may compensate for the loss in the enrollment of the other group. Consequently, the impact of tuition discounts had on the overall racial/ethnic diversity of the student body did not appear to be significant.

The findings related to low-income student enrollment suggest that tuition discount rate is a positive predictor of the percentage of Pell-receiving students; in particular, the association was more notable at more selective colleges and universities than at less selective institutions. Regarding non-resident students, no statistically significant relationships were found between the percentage of non-resident students and tuition discount rate. Overall, these findings do not support the prior argument that the use of tuition discounting practices hinders the college access of low-income students. Instead, these results suggest that tuition discount rate increases the percentage of low-income students at more selective public colleges and universities, thereby suggesting the positive impact of tuition discounting on the enrolment of low-income students. However, it is still unclear whether the percentage of low-income students was influenced by need-based or non-need-based tuition discounts. It is possible that the percentage of low-income students increased since colleges and universities offered tuition discounts based on students' financial need, and the shifts in discounts from need-based to non-need-based may have changed the results. As such, the results highlight the importance of exploring the effects that different types of institutional grants have on student enrollment outcomes.

Taken together, this dissertation study provides evidence that tuition discounting can be an effective enrollment management tool that helps support the enrollment of both low-income students and certain underrepresented minority students. In contrast to the argument of prior studies, the use of tuition discounts did not significantly increase the enrollment of non-resident students, and its effect on total student enrollment was not observed to be significant.

Taking into account the moderating effects of the share of state spending on need-based grants and institutional financial health on the relationship between tuition discount rate and various student enrollment outcomes shifted the results of the primary analysis. Particularly, the share of states' spending on need-based grants was found to be a significant moderator for the enrollment of racial/ethnic minority, low-income, and non-resident student groups. For racial/ethnic minority and low-income students, state spending on need-based grants strengthened their positive relationships with tuition discount rate, whereas the same moderating factor mitigated the positive relationship between tuition discount rate and the percentage of non-resident students. Contrary to the study's expectation, institutional financial health was not found to be a significant moderator for the most part. In fact, it only weakened the positive association between tuition discounts and the percentage of non-resident students at the less selective institutions.

With regard to whether the institutional emphasis on need-based institutional grants over non-need-based institutional grants was associated with total enrollment and the enrollment of certain subgroups of students, an increase in the share of need-based institutional grants was not significantly associated with overall student enrollment and the percentage of non-resident students. However, the results also suggest that an increase in the share of need-based institutional grants was effective in increasing the percentage of underrepresented minority

students for all sample institutions and for less selective institutions in particular. Moreover, the same increase in the share of need-based institutional grants was also positively associated with the percentage of low-income students at more selective colleges and universities. The findings imply that institutional grant type is associated with the enrollment of underrepresented minority and low-income students and reinforce the argument that shifts in institutional grants from need-based to non-need-based can impede student diversity within public colleges and universities. Below, I further discuss the findings based on the conceptual framework that guided this study.

Supply, Demand, and Competitive Markets and Cost/Benefit Analysis

The concepts of supply, demand, and competitive markets and the notion of cost/benefit analysis suggest several factors that might influence the decisions of students and higher education institutions and help explain why these institutions engage in tuition discounting practices. From the perspective of institutions, colleges and universities need to attract the types of students that align with their institutional goals. Thus, tuition discounts can be used as an enrollment management tool to attract students that interest them and be more successful tool in competing with other higher education institutions. From the student perspective, college price is an important factor that can determine their college enrollment decision; a reduction in college price resulting from a tuition discount can increase a student's likelihood of choosing the college that offers more generous discounts than other higher education institutions.

Based on these concepts, one might presume that tuition discounts might at least increase total enrollment and the enrollment of specific student populations to some extent. However, tuition discounting was not associated with an increase in total student enrollment, and that it was only effective for increasing the enrollment of some student groups (i.e., Hispanic students and low-income students). It may be the case that, as the concepts of demand and cost/benefit

analysis suggests, college price is one of many factors that shape students' decision to enroll in college. What this implies is that some students' decision to enroll in a particular college could change due to reductions in college price, whereas these discounts would not influence the college choice of other students less concerned about this issue. For instance, price-sensitive students, whose enrollment decisions depend on college price, would likely enroll in a college that offers tuition discounts. On the contrary, for the other students, the same amount of tuition discounts may not be sufficient to change their latent demand to enroll in the institution that offers tuition discounts.

Differences in the estimated relationships between tuition discounts and various enrollment outcomes, thus, suggest that the relative importance of tuition discounts and college price can vary from student to student and that the non-financial aspects of institutions are also important to the college decisions of some students.

Microeconomic Theory of Nonprofit Firm Behavior

The microeconomic theory of nonprofit firm behavior posits that institutions have their own distinctive objectives and values, and using their limited resources rationally, these institutions try to maximize their utility and achieve their institutional objectives. To that end, institutions may use different tuition discounting approaches to attract students whose characteristics align well with their institutional goals.

Based on this theory, it is assumed that the use of tuition discounting may vary by institutional type, which may result in different student enrollment outcomes. For instance, more selective institutions may use tuition discounts to attract students from a variety of backgrounds. On the other hand, for those institutions that aim to increase institutional selectivity, tuition

discounts may be awarded to students with high academic achievement. Consequently, the effects of tuition discounts could vary across institutions.

Not surprisingly, the descriptive statistics of the need-based and non-need-based tuition discounts suggest that the types of tuition discounts institutions offer differ across institutions. For instance, it was found that more selective institutions awarded tuition discounts based more on students' financial need, while less selective institutions awarded discounts based more on non-financial aspects. These findings comply with what has been theoretically described in the microeconomic theory of nonprofit behaviors. That is, colleges and universities do not have same institutional goals, which leads them to emphasize different types of tuition discounting practices to attract the students they desire.

Tuition Discounting Hypotheses

Only some findings of this dissertation study align with the hypotheses presented in Chapter 2. Although one hypothesis expected a positive association between tuition discount rate and the aggregate enrollment of undergraduate students, no statistical relationships were found between the two. Regarding the enrollment of subgroups of students, tuition discounting was predicted to be positively associated with the percentage of underrepresented minority and low-income students; a negative association was expected between tuition discount rate and the percentage of non-resident students. Only the results of the low-income students were consistent with the hypothesis. This study initially posited that students' demand to enroll in a particular institution could be influence by college price. However, as mentioned previously, it is possible that non-price-sensitive students would choose their higher education institution not based on college price but rather on other non-financial institutional aspects, such as reputation and student services.

The initial hypotheses also held that the associations between the percentage of underrepresented minority and low-income students and tuition discount rate would be weaker at more selective institutions than non-selective institutions, while expecting the opposite for the non-resident students. However, for these more selective institutions, the percentage of low-income students increased as the percent of tuition discounts increased. It is possible that, since more selective institutions already have applicant pools of high achieving students, these institutions offer tuition discounts to needy students with the expectation that admitting needy students will enhance their institutional prestige. It may also be the case that more selective institutions award tuition discounts to low-income students with scholarly ability. For the other outcome variables, no significantly different results were found between more selective and less selective institutions.

Turning to the moderator of state spending on need-based grants, the relationships between tuition discount rate and the percentages of underrepresented minority and low-income students were predicted to be stronger as the share of state spending on need-based grants increased. This moderator also was thought to mitigate the positive association between tuition discount rate and non-resident students. Indeed, the results were consistent with the hypotheses—that percentages of underrepresented minority and low-income students were more likely to increase while the percentage of non-resident students was more likely to decrease as state-funded need-based grants increased. It is likely that state spending on need-based grants in addition to tuition discounts can increase the latent demand of additional students who would otherwise not want to attend a college that offer tuition discounts. Consequently, the increase in the percentage of racial/ethnic minorities and low-income students became stronger.

With respect to institutional health, only the findings for non-resident students at less selective institutions were statistically significant. Inconsistent with the hypothesis, the positive relationship between tuition discount rate and non-resident students became mitigated as institutions' financial health strengthened. The results again may be related to non-financial factors that students consider when they make college decisions. Perhaps non-resident students, who tend to be high-achieving and wealthy, are less likely to attend less selective institutions regardless of institutional financial condition since they would prefer to attend more selective private or public flagship institutions. It is also important to think about why institutional health was not a significant factor that moderated the relationship between tuition discounts and various enrollment outcomes. It may be the case that institutions' financial status would not be a factor that students consider when making their college enrollment decisions, and therefore, its effect as a moderator may not be substantial to this analyses. It is also possible that the surplus margin ratio would not be a suitable proxy to represent true institutional financial health status.

Lastly, the hypothesis also stated that an increased share of need-based institutional grants would be positively associated with the enrollment of underrepresented minority students and low-income students. The findings tend to align with these hypotheses. Indeed, the percentage of low-income students increased as the share of need-based institutional grants increased; the percentage of low income students was positively associated with the amount of need-based grants awarded by the more selective sample institutions. However, with regards to total enrollment and the percentage of non-resident students, no statistically significant relationships emerged.

Implications and Future Research

While this dissertation study lays the groundwork for future research, a great deal of potential areas remain in need of future research. First, this study incorporates the percentage of underrepresented minorities, low-SES students, and non-resident students as proxies to represent institutional student body composition and explore the changes that tuition discounting brought to public colleges and universities. However, it did not show in which way student composition has changed over time. To that end, future studies on student composition within higher education could develop a measure that captures "the diversity of students across attributes" rather than one that represents the changes in "the level of attributes" (Toutkoushian, forthcoming). Similarly, although this study focuses on the three measures of underrepresented minority status, low-income status, and residency, future studies could also examine how tuition discounting can influence the enrollment of students with other characteristics, such as first-generation status, gender, and major.

In exploring the association between tuition discounting and the percentage of each underrepresented minority student group, the results also show that the effect of tuition discounts varied by race and ethnicity. The findings suggest that uncovering what factors are influencing these groups may explain the differences in enrollment outcomes for each population. To that end, although it is beyond the scope of this dissertation study, future researchers may choose to analyze how and why the effect of tuition discounting varies among students along racial and ethnic lines.

Third, using definition commonly adopted by prior studies, the results of this dissertation study helped uncover the effects that tuition discounts have on full-time students' enrollment and the student composition of full-time, first-time students at public four-year colleges and

universities. However, the institutional grants information that was used to ascertain tuition discounts amounts included institutional grants awarded to all types of students enrolled in these institutions. Thus, the information described tuition discounts that were awarded to all students rather than to full-time, first-time undergraduate students only. Accordingly, the results of the study have limited capacity to show more accurate relationships between tuition discounts and the enrollment of subgroups of the student body. Future studies, if possible, could calculate the tuition discounts for each type of student group and determine whether or not these institutions offer different levels of tuition discounts to particular student groups, and whether such practices result in their desired enrollment outcomes.

Another limitation of this study is that, although it controls for in-state and out-of-state tuition and fees to assess the relationship between tuition discount rate and various student enrollment outcomes, it did not account for the institutional behaviors of setting different levels of tuition and fees for in-state and out-of-state students and offering different tuition discount rates according to the tuition and fees charged to these students. To be specific, it is often the case that some public higher education institutions charge higher tuition rates for out-of-state students and award higher tuition discounts rates. On the other hand, the tuition rates for in-state students are relatively lower, and the level of discount rates these students receive is also lower than their non-resident counterparts. To better understand the practices of tuition discounting at public colleges and universities, future studies, thus, could consider this unique relationship between tuition and fees and tuition discounting and explore how such practices result in unintended consequences at public higher education institutions.

By utilizing the variable for the share of need-based institutional grants awarded to students, this study also provides evidence of whether or not the shift in awarding institutional

grants from need-based to non-need-based has occurred in public institutions, and whether such a practice has influenced the total enrollment and enrollment of subgroups of students. The results, then, support prior studies' arguments that the increased use of non-need-based tuition discounts hinders college access for students from historically marginalized backgrounds. However, it is often the case that colleges and universities offer both need-based and non-need-based institutional grants, since these institutions have multiple motivations or institutional goals that they wish to attain, rather than having a single goal of either increasing total enrollment or institutional revenue. Although it is beyond the scope of this study, future research can explore the various institutional motivations for implementing tuition discounting practices, and whether or not these motivations differ substantially by institutional contexts. Future studies could also explore whether the types of discounting practices that institutions utilize vary by their motivations.

Lastly, this study considered tuition discounting as a strategy to increase the enrollment of students and provided evidence of whether its use is effective in achieving these enrollment management objectives. However, a plethora of prior studies have also suggested that tuition discounting can be used as a revenue management tool (e.g., Davis, 2003; Duggan & Mathews, 2015; Hillman, 2012; Noel-Levitz, 2012; Redd, 2000). In fact, student enrollment and institutional revenue are two inseparable goals for higher education institutions, and the practice of tuition discounting alone could not be implemented to achieve the institutional goals of student enrollment and revenue generation. Given these contexts, it is worthwhile to explore how institutions simultaneously adopt various institution-level practices in addition to tuition discounting and examine whether and what kinds of changes these policies can bring to the institutions that enact them.

Conclusion

This dissertation study contributes to the literature of tuition discounting in a variety of ways. First, I examined the associations between tuition discounting and various student enrollment outcomes at public four-year colleges and universities. Second, I also explored whether institution and state-level factors could moderate the relationships between tuition discounting and student enrollment and student body composition. Third, I also assessed how institutions' emphasis on awarding institutional grants based on students' financial needs over non-financial aspects affects student enrollment and composition.

Overall, the results provide evidence that tuition discounting is a useful tool in diversifying student body composition by increasing the percentage of some underrepresented minority groups and low-income students. Additionally, the findings confirm the need for considering institutional and state-level factors that may influence the relationships between tuition discounts and student enrollment outcomes. Finally, the study revealed that that public colleges and universities still provide a majority of their institutional grants based on students' financial need rather than for non-financial factors, although the share of need-based institutional grants has remained constant over the years. The results also suggest that the increase in the share of need-based institutional grants was positively related to the percentage of underrepresented minority and low-income students.

It is likely that tuition discounting practices will become more prevalent at public colleges and universities over time. The current dissertation study suggests that the impact of tuition discounts can differ by how public colleges and universities use the policy for their students. Although tuition discounting could succeed in increasing the percentage of underrepresented minority or low-income students, such results could change if institutions'

emphasis on need-based tuition discounts over non-need-based discounts were to shift. It is also likely that institutional and state-level characteristics may amplify or weaken the effect of tuition discounts on student enrollment and student body composition. Thus, to maximize the positive impact of tuition discounting practices for public colleges and universities, these institutions need to consider their institutional and state contexts and utilize tuition discounting practices accordingly.

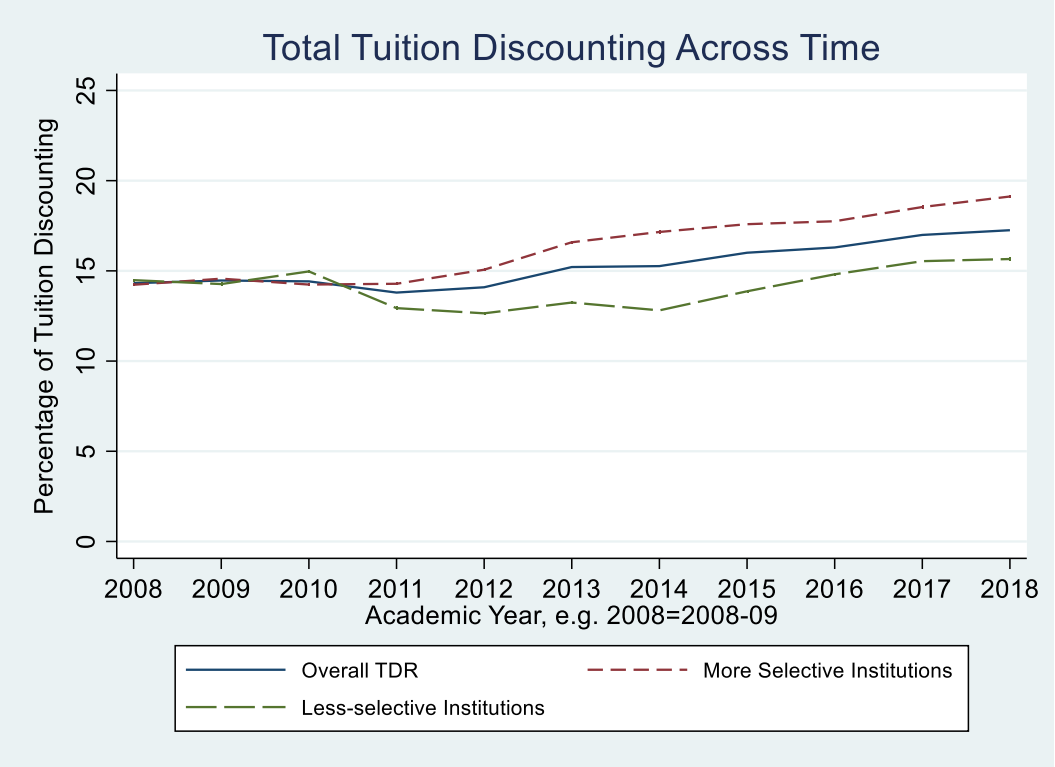

Figure 4.1: Percentage of Total Tuition Discounting across Time

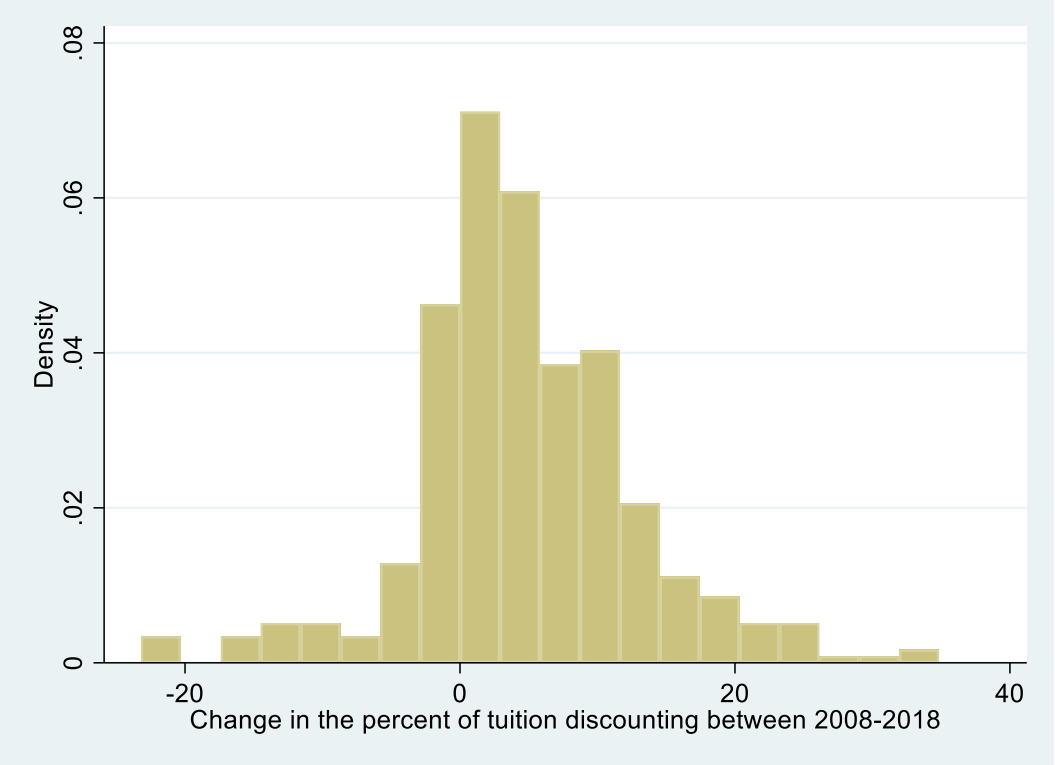

Figure 4.2: Histogram of Percent Changes in Tuition Discount, 2008-2018

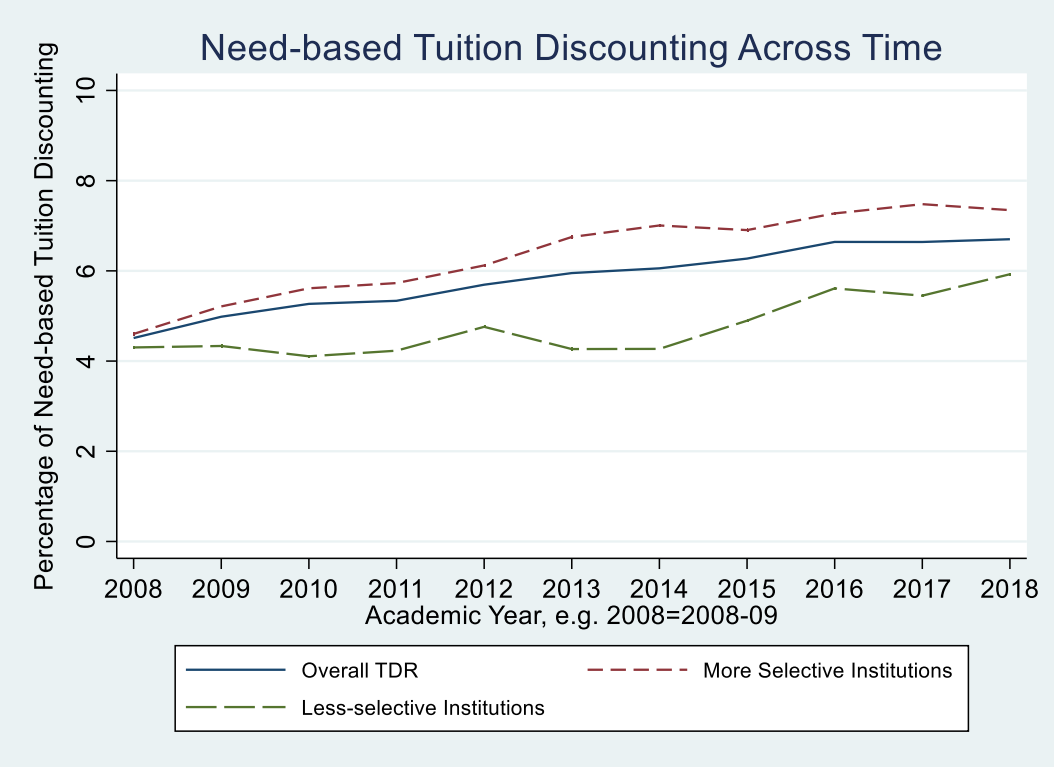

Figure 4.3: Percentage of Need-based Tuition Discounting Rate across Time

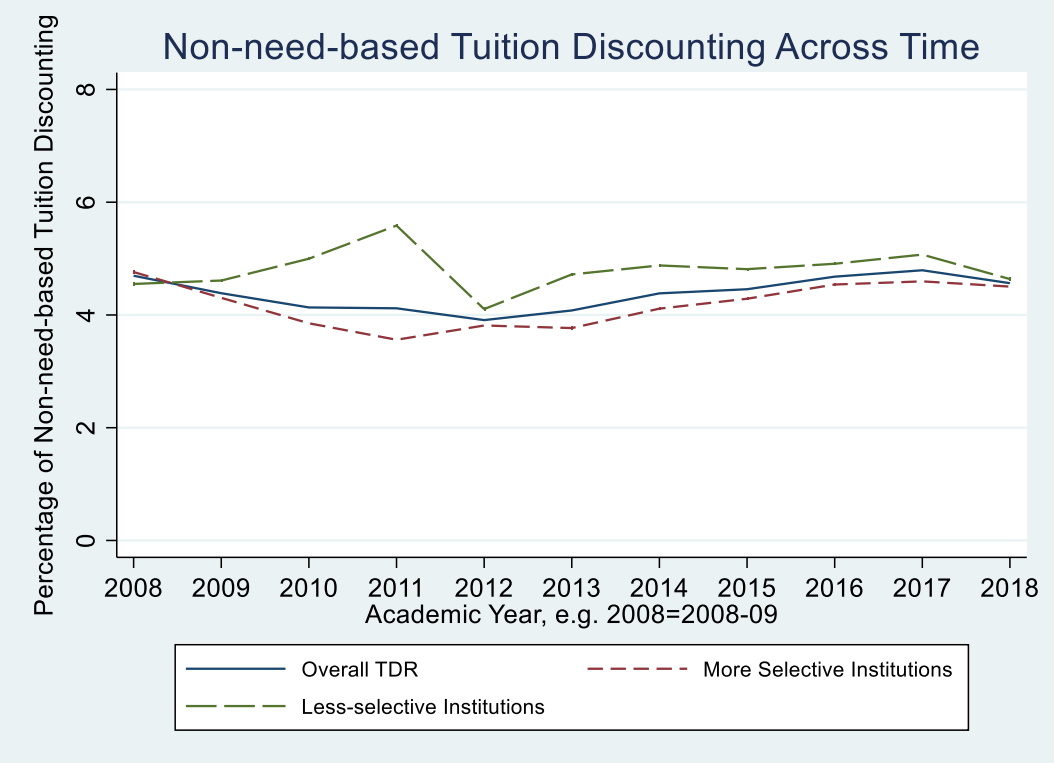

Figure 4.4: Percentage of Non-need-based Tuition Discounting Rate across Time

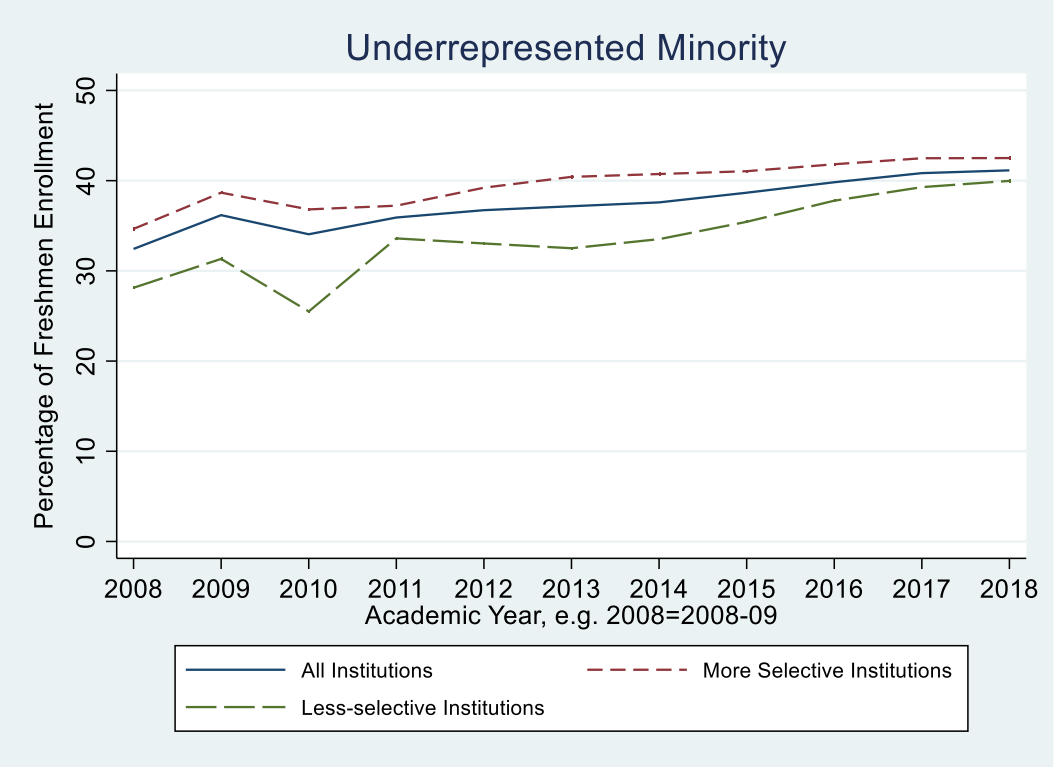

Figure 4.5: Percentage of Underrepresented Minority Freshmen Enrollment of across Time

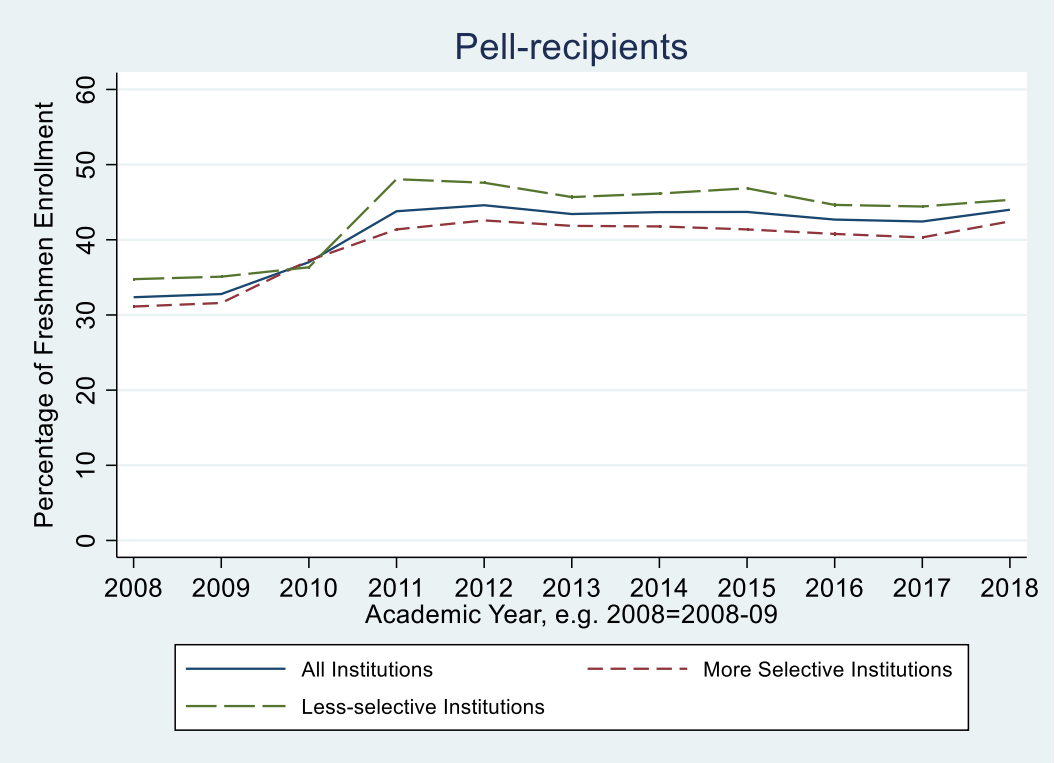

Figure 4.6: Percentage of Pell-Receiving Freshmen Enrollment of across Time

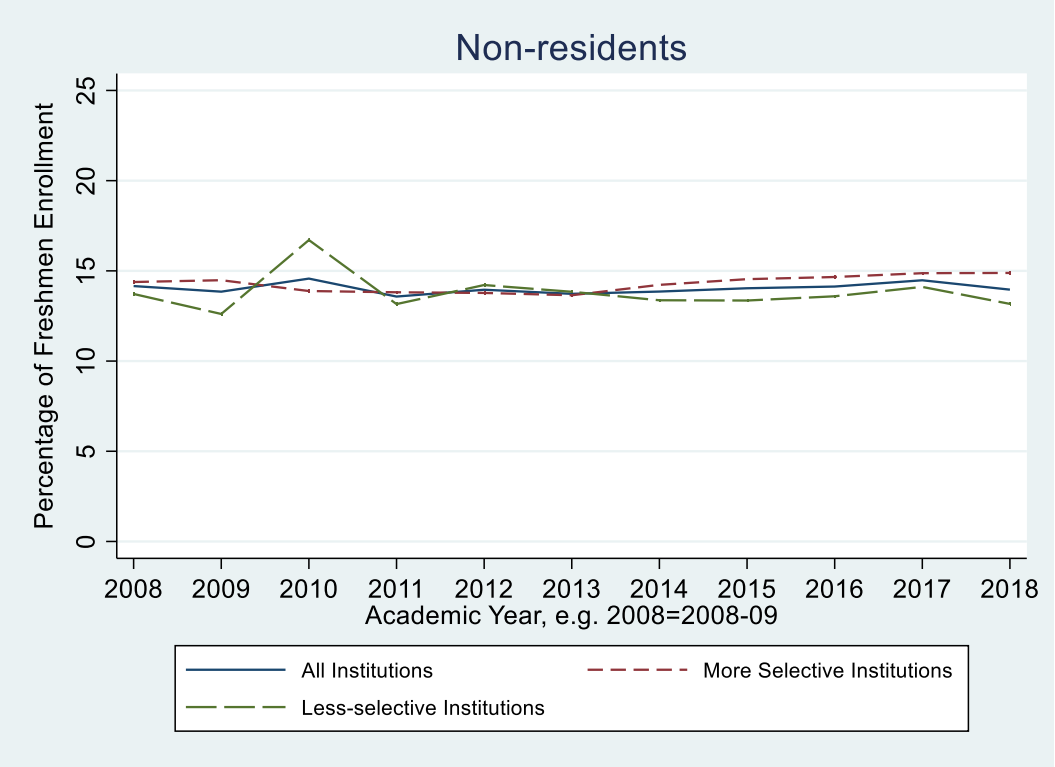

Figure 4.7. Percentage of Non-resident Freshmen Enrollment of across Time

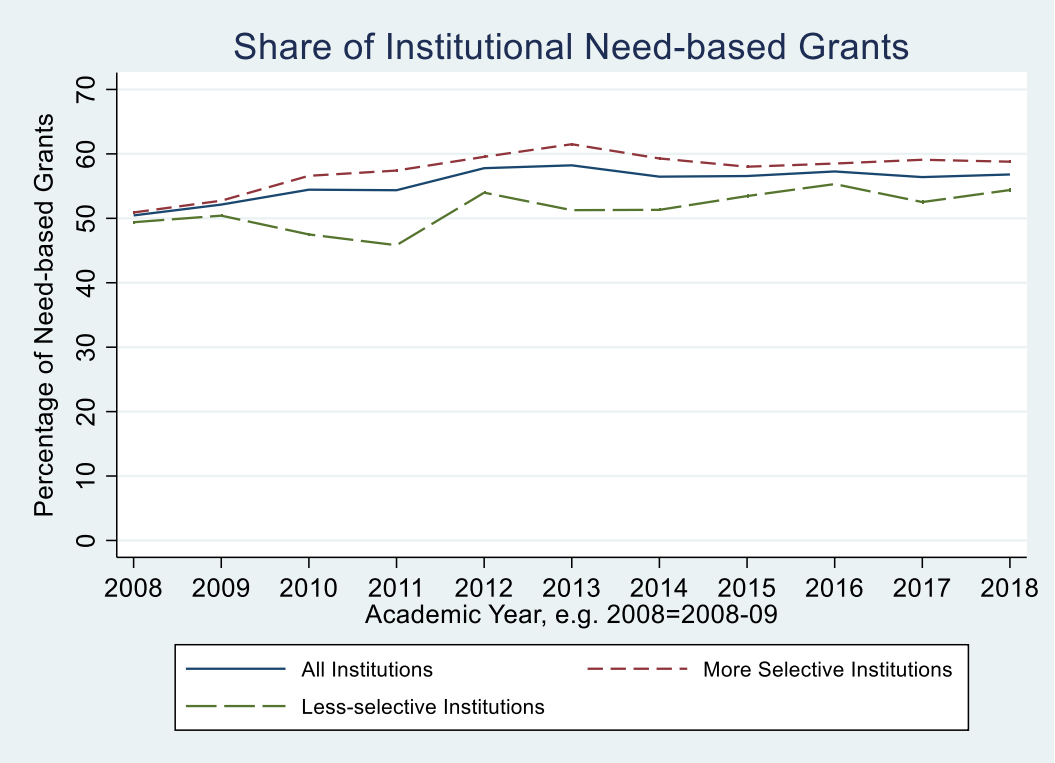

Figure 4.8. The Share of Institutional Need-based Grants across Time

Table 4.1: Descriptive Statistics for Variables Used in Regression Models (Year=2016)

	N	Mean	SD	Min	Max
Tuition Discount	581	16.30	10.04	0.00	79.66
Share of Inst. Need-based Grants	384	0.57	0.30	0.00	1.00
Full-time Undergraduate Enrollment[a]	581	84.95	80.26	1.41	449.75
Full-time Freshmen Enrollment[a]	581	18.33	17.05	0.36	89.55
Percent: URM	581	39.82	23.46	4.87	99.84
Percent: Pell-recipients	581	42.69	15.90	9.00	89.00
Percent: Non-resident	581	14.13	14.59	0.00	80.00
Percent: White	581	55.40	25.02	0.16	94.70
Percent: Black	581	14.69	20.03	0.00	96.91
Percent: Hispanic	581	14.50	16.21	0.00	95.89
Percent: Asian	581	4.77	7.03	0.00	46.25
Percent: Other races	581	10.44	8.01	0.65	97.86
Percent: State's Need-based Grants	581	7.49	5.33	0.00	20.89
Surplus Margin[b]	581	0.03	0.08	-0.41	0.38
Tuition/fee: In-state[c]	581	69.18	30.19	0.73	166.23
Tuition/fee: Out-of-state[c]	581	176.98	80.48	0.73	510.70
Avg Amt Grant from State/local Govt[d]	581	3.51	2.06	0.19	11.62
Avg Amt of Federal Grant[d]	581	5.60	1.02	1.54	11.49
Avg Amt of Loan[d]	581	6.58	1.57	1.54	12.93
75th percentile SAT/ACT Math scores	581	581.79	57.58	430.00	790.00
No SAT Score	581	0.26	0.44	0.00	1.00
Acceptance Rate	581	76.69	19.58	16.00	100.00
Personal Income per Capita[e]	581	51.00	7.47	37.61	72.41
Poverty Rate	581	12.76	2.76	6.40	21.10
Unemployment Rate	581	4.80	0.76	2.90	6.60
Pct Black ages 18-24	581	15.83	10.14	1.48	44.21
Pct Hispanic ages 18-24	581	17.63	14.35	2.22	56.83
N	581				

[a] In hundreds

[b] As a proportion to total revenue

[c] In hundreds, adjusted to 2018 dollars

[d] In thousands, adjusted to 2018 dollars

[e] Total amount was divided by state's population ages 18-24

Table 4.2: Means of Time-varying Factors for Public Four-year Institutions

Year	% TDR	Share of Need Grants	FTE Enrollment[a]	FTFT Enrollment[a]	% URM	% Low-income	% Non-resident
2008	14.32	50.45	84.66	18.11	32.43	32.36	14.16
2009	14.47	52.13	86.25	18.04	36.18	32.78	13.85
2010	14.42	54.44	94.96	19.26	34.06	37.03	14.57
2011	13.76	54.36	87.73	18.28	35.91	43.79	13.58
2012	14.05	57.78	87.16	18.10	36.73	44.60	13.96
2013	15.24	58.26	86.42	18.18	37.17	43.43	13.73
2014	15.27	56.47	85.66	18.20	37.59	43.68	13.85
2015	16.01	56.52	85.99	18.40	38.66	43.71	14.04
2016	16.30	57.24	84.95	18.33	39.82	42.69	14.13
2017	17.00	56.36	84.81	18.43	40.84	44.44	14.48
2018	17.26	56.65	84.11	18.60	41.14	44.00	13.96

[a] In hundreds

4.3: The Relationship between Tuition Discounting and Full-time Undergraduate Enrollment

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.173*	0.162*	0.084	0.076	0.018
	(0.069)	(0.068)	(0.059)	(0.082)	(0.058)
Tuition/fee: In-state[a]	-0.073+	-0.073+	-0.080*	-0.151**	0.012
	(0.038)	(0.037)	(0.037)	(0.048)	(0.055)
Tuition/fee: Out-of-state[a]	0.105***	0.102***	0.105***	0.132***	0.043*
	(0.020)	(0.020)	(0.021)	(0.030)	(0.020)
Avg Amt Grant from State/local Govt[b]	-0.171	-0.182	-0.310	-0.536	-0.502
	(0.268)	(0.266)	(0.259)	(0.346)	(0.413)
Avg Amt of Federal Grant[b]	-0.410	-0.417	-0.507	-0.758	-0.232
	(0.706)	(0.702)	(0.738)	(0.941)	(0.933)
Avg Amt of Loan[b]	0.659	0.660	0.815	0.656	0.799
	(0.593)	(0.589)	(0.632)	(0.760)	(0.844)
75th percentile SAT/ACT Math scores		0.022*	0.022*	0.023*	-0.030
		(0.010)	(0.010)	(0.011)	(0.021)
No SAT Score		2.627+	1.538	-1.801	3.977*
		(1.575)	(1.456)	(1.568)	(1.627)
Acceptance Rate		-0.034	-0.015	-0.025	0.074
		(0.025)	(0.022)	(0.040)	(0.084)
Personal Income per Capita			0.422*	0.556*	0.211
			(0.200)	(0.268)	(0.207)
Unemployment Rate			-0.806*	-1.213*	0.441
			(0.351)	(0.481)	(0.488)
Poverty Rate			-0.277+	-0.053	-0.259+
			(0.144)	(0.189)	(0.142)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			-185.383*	-83.295	183.056
			(86.077)	(118.287)	(151.886)
Pct: Hispanic Pop 18-24			202.350**	446.127***	17.709
			(69.371)	(89.148)	(111.003)
AY 2009-2010	2.623***	2.598***	5.934***	6.384***	2.913*
	(0.348)	(0.352)	(1.178)	(1.669)	(1.441)
AY 2010-2011	4.035***	3.960***	7.193***	7.433***	3.720*
	(0.469)	(0.483)	(1.308)	(1.875)	(1.761)
AY 2011-2012	5.605***	5.624***	8.105***	6.914***	4.600**
	(0.545)	(0.550)	(1.294)	(1.889)	(1.590)
AY 2012-2013	5.526***	5.600***	7.359***	5.865**	3.334+
	(0.592)	(0.593)	(1.333)	(1.929)	(1.880)
AY 2013-2014	4.994***	5.110***	6.358***	5.092*	1.635
	(0.689)	(0.688)	(1.393)	(2.001)	(2.030)
AY 2014-2015	5.297***	5.363***	4.866**	3.035	1.412
	(0.755)	(0.757)	(1.518)	(2.101)	(2.511)
AY 2015-2016	5.464***	5.536***	2.771	0.630	0.741
	(0.847)	(0.850)	(1.800)	(2.531)	(2.930)
AY 2016-2017	5.872***	6.004***	1.901	-0.505	0.587
	(0.942)	(0.950)	(1.967)	(2.771)	(3.295)
AY 2017-2018	6.694***	6.546***	0.864	-1.576	0.984
	(1.010)	(0.980)	(2.117)	(2.871)	(3.680)
AY 2018-2019	6.690***	6.537***	-1.025	-3.600	0.310
	(1.112)	(1.079)	(2.373)	(3.130)	(4.028)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	64.242***	54.258***	38.682+	-8.863	25.167
	(3.230)	(6.712)	(21.282)	(32.864)	(31.516)
Sample Size	5931	5931	5931	3459	2472
R-Squared	0.99	0.99	0.99	0.99	0.99
Fixed Effects vs. Pooled (F-Test)	234.05***	673.40***	10293.52***	4864.63***	1835.97***
Fixed vs. Random Effects (χ^2)	244.59***	315.23***	354.91***	206.22***	177.98***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.4: The Relationship between Tuition Discounting and Full-time Freshmen Enrollment

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Less-selective Inst.**
Tuition Discount Rate	0.027+	0.025	0.008	-0.002	-0.000
	(0.016)	(0.016)	(0.015)	(0.021)	(0.016)
Tuition/fee: In-state[a]	-0.022*	-0.022*	-0.023*	-0.038**	-0.009
	(0.010)	(0.010)	(0.010)	(0.012)	(0.014)
Tuition/fee: Out-of-state[a]	0.026***	0.025***	0.026***	0.032***	0.014**
	(0.005)	(0.005)	(0.005)	(0.007)	(0.004)
Avg Amt Grant from State/local Govt[b]	0.025	0.022	-0.007	-0.005	-0.088
	(0.076)	(0.076)	(0.074)	(0.103)	(0.100)
Avg Amt of Federal Grant[b]	-0.253	-0.253	-0.279	-0.391+	-0.279
	(0.164)	(0.164)	(0.174)	(0.231)	(0.207)
Avg Amt of Loan[b]	0.296*	0.297*	0.338*	0.330+	0.410*
	(0.137)	(0.136)	(0.146)	(0.171)	(0.176)
75th percentile SAT/ACT Math scores		0.005+	0.005+	0.002	-0.003
		(0.003)	(0.003)	(0.003)	(0.003)
No SAT Score		0.519	0.289	-0.133	0.755
		(0.440)	(0.416)	(0.460)	(0.518)
Acceptance Rate		-0.000	0.004	0.006	0.018
		(0.006)	(0.006)	(0.009)	(0.020)
Personal Income per Capita			0.109*	0.138*	0.068
			(0.047)	(0.067)	(0.046)
Unemployment Rate			-0.173+	-0.231+	0.129
			(0.093)	(0.133)	(0.132)
Poverty Rate			-0.073+	-0.034	-0.072
			(0.038)	(0.050)	(0.045)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Less-selective Inst.**
Pct: Black Pop 18-24			-31.536	-7.746	58.689
			(22.706)	(30.592)	(38.773)
Pct: Hispanic Pop 18-24			46.439**	99.509***	26.853
			(15.879)	(22.858)	(21.241)
AY 2009-2010	0.126	0.125	0.869**	0.709	0.323
	(0.115)	(0.116)	(0.316)	(0.476)	(0.388)
AY 2010-2011	0.115	0.115	0.814*	0.780	-0.303
	(0.139)	(0.141)	(0.346)	(0.525)	(0.413)
AY 2011-2012	0.584***	0.599***	1.077**	0.675	0.094
	(0.156)	(0.156)	(0.343)	(0.507)	(0.431)
AY 2012-2013	0.461**	0.481**	0.768*	0.406	-0.411
	(0.169)	(0.168)	(0.346)	(0.506)	(0.496)
AY 2013-2014	0.584**	0.604**	0.764*	0.416	-0.584
	(0.189)	(0.188)	(0.354)	(0.489)	(0.557)
AY 2014-2015	0.808***	0.813***	0.570	0.176	-0.592
	(0.197)	(0.196)	(0.376)	(0.490)	(0.656)
AY 2015-2016	0.968***	0.978***	0.191	-0.353	-0.674
	(0.217)	(0.217)	(0.444)	(0.597)	(0.749)
AY 2016-2017	1.108***	1.122***	0.030	-0.508	-0.761
	(0.251)	(0.252)	(0.485)	(0.663)	(0.826)
AY 2017-2018	1.416***	1.364***	-0.085	-0.561	-0.700
	(0.258)	(0.255)	(0.522)	(0.716)	(0.890)
AY 2018-2019	1.676***	1.615***	-0.269	-0.534	-0.820
	(0.285)	(0.280)	(0.580)	(0.782)	(0.960)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Less-selective Inst.**
Constant	13.581***	10.867***	5.112	-4.938	-2.741
	(0.785)	(1.620)	(5.458)	(8.244)	(7.804)
Sample Size	5931	5931	5931	3459	2472
R-Squared	0.98	0.98	0.98	0.98	0.98
Fixed Effects vs. Pooled (F-Test)	210.02***	808.53***	5569.16***	350.24***	1575.25***
Fixed vs. Random Effects (χ^2)	196.57***	263.88***	284.58***	170.31***	171.01***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.5: The Relationship between Tuition Discounting and the Percentage of Underrepresented Minority Students

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.031	0.024	-0.003	0.023	-0.042
	(0.029)	(0.029)	(0.027)	(0.037)	(0.037)
Tuition/fee: In-state[a]	0.028+	0.027+	0.026+	0.035+	0.018
	(0.016)	(0.015)	(0.014)	(0.018)	(0.028)
Tuition/fee: Out-of-state[a]	-0.008	-0.008	-0.006	-0.015	-0.002
	(0.008)	(0.008)	(0.007)	(0.010)	(0.011)
Avg Amt Grant from State/local Govt[b]	0.212+	0.244*	0.193+	0.291+	0.117
	(0.125)	(0.123)	(0.113)	(0.167)	(0.125)
Avg Amt of Federal Grant[b]	0.702*	0.697*	0.533+	0.435	0.840*
	(0.315)	(0.311)	(0.288)	(0.367)	(0.363)
Avg Amt of Loan[b]	-0.570*	-0.576*	-0.401	-0.292	-0.738*
	(0.279)	(0.277)	(0.253)	(0.313)	(0.342)
75th percentile SAT/ACT Math scores		-0.012*	-0.013*	-0.017*	0.001
		(0.006)	(0.006)	(0.007)	(0.008)
No SAT Score		3.454***	2.936***	1.843+	3.346**
		(0.736)	(0.726)	(1.086)	(1.080)
Acceptance Rate		-0.029*	-0.015	-0.044**	-0.025
		(0.012)	(0.011)	(0.016)	(0.044)
Personal Income per Capita			0.078	0.141	0.006
			(0.094)	(0.116)	(0.160)
Unemployment Rate			-0.463*	-0.443+	-0.483+
			(0.191)	(0.268)	(0.256)
Poverty Rate			0.199**	0.312**	0.073
			(0.075)	(0.106)	(0.110)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			47.342	124.032*	-76.229
			(41.323)	(53.983)	(59.703)
Pct: Hispanic Pop 18-24			187.909***	194.186***	157.151***
			(19.748)	(28.178)	(28.689)
AY 2009-2010	3.696***	3.693***	4.554***	4.722***	4.138**
	(0.644)	(0.643)	(0.994)	(1.402)	(1.348)
AY 2010-2011	2.003***	2.041***	2.052**	1.410	3.230**
	(0.376)	(0.388)	(0.659)	(0.939)	(0.990)
AY 2011-2012	3.549***	3.555***	2.899***	1.246	5.532***
	(0.371)	(0.375)	(0.639)	(0.843)	(0.998)
AY 2012-2013	4.490***	4.552***	3.080***	1.441+	5.741***
	(0.368)	(0.369)	(0.659)	(0.814)	(0.991)
AY 2013-2014	4.850***	4.966***	2.972***	1.605+	5.249***
	(0.372)	(0.371)	(0.679)	(0.887)	(1.004)
AY 2014-2015	5.292***	5.334***	2.200**	0.717	4.947***
	(0.396)	(0.392)	(0.777)	(1.003)	(1.113)
AY 2015-2016	6.189***	6.193***	2.284**	1.098	4.697***
	(0.412)	(0.405)	(0.855)	(1.105)	(1.231)
AY 2016-2017	6.943***	7.006***	2.456**	1.282	5.130***
	(0.459)	(0.451)	(0.897)	(1.125)	(1.327)
AY 2017-2018	7.506***	7.748***	2.489**	1.672	4.795***
	(0.460)	(0.468)	(0.949)	(1.217)	(1.364)
AY 2018-2019	8.044***	8.342***	2.307*	1.727	4.627**
	(0.481)	(0.488)	(1.015)	(1.327)	(1.457)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	30.631***	39.399***	-1.006	-16.042	17.698
	(1.438)	(3.652)	(9.810)	(13.386)	(13.626)
Sample Size	5931	5931	5931	3459	2472
R-Squared	0.94	0.95	0.95	0.94	0.96
Fixed Effects vs. Pooled (F-Test)	1350.44***	898.43***	2011.56***	666.37***	509.30***
Fixed vs. Random Effects (χ^2)	214.02***	460.15***	469.65***	486.85***	190.83***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.6: The Relationship between Tuition Discounting and Each Underrepresented Minority Student Group

	Black	**Asian**	**Hispanic**	**Other**
Tuition Discount Rate	-0.045*	0.002	0.052***	-0.010
	(0.021)	(0.006)	(0.012)	(0.031)
Tuition/fee: In-state[a]	0.003	0.002	0.026**	-0.003
	(0.011)	(0.004)	(0.009)	(0.015)
Tuition/fee: Out-of-state[a]	0.001	0.003+	-0.006*	-0.001
	(0.006)	(0.002)	(0.003)	(0.007)
Avg Amt Grant from State/local Govt[b]	-0.039	-0.084	0.021	0.204+
	(0.071)	(0.053)	(0.059)	(0.113)
Avg Amt of Federal Grant[b]	-0.155	-0.129*	0.376**	0.301
	(0.209)	(0.059)	(0.119)	(0.290)
Avg Amt of Loan[b]	0.404*	0.081	-0.289**	-0.512+
	(0.205)	(0.054)	(0.097)	(0.283)
75th percentile SAT/ACT Math scores	-0.021***	0.004**	-0.008***	0.016**
	(0.005)	(0.001)	(0.002)	(0.006)
No SAT Score	2.458***	-0.282+	1.403**	-0.919
	(0.628)	(0.170)	(0.436)	(0.756)
Acceptance Rate	0.003	0.000	0.005	-0.024+
	(0.010)	(0.003)	(0.005)	(0.014)
Personal Income per Capita	0.320***	-0.019	0.247***	-0.483***
	(0.067)	(0.022)	(0.048)	(0.110)
Unemployment Rate	0.246+	0.133**	0.151*	-0.863***
	(0.131)	(0.041)	(0.074)	(0.233)
Poverty Rate	-0.030	-0.051***	-0.132***	0.367***
	(0.062)	(0.014)	(0.030)	(0.099)
Pct: Black Pop 18-24	-12.037	-2.295	-34.187+	98.004+
	(41.126)	(10.149)	(17.793)	(57.087)
Pct: Hispanic Pop 18-24	-32.927*	-27.248***	137.331***	80.961***
	(13.221)	(7.234)	(13.008)	(21.599)
AY 2009-2010	-0.556	-0.343**	-0.288	5.432***
	(0.498)	(0.128)	(0.287)	(1.254)
AY 2010-2011	-0.263	-0.590***	0.707**	1.513*
	(0.470)	(0.142)	(0.266)	(0.704)
AY 2011-2012	-0.338	-0.371**	1.050***	2.076***
	(0.402)	(0.137)	(0.244)	(0.602)
AY 2012-2013	-0.417	-0.182	1.557***	1.815**
	(0.415)	(0.140)	(0.241)	(0.655)

	Black	Asian	Hispanic	Other
AY 2013-2014	-0.079	0.089	1.951***	0.976
	(0.479)	(0.159)	(0.266)	(0.706)
AY 2014-2015	-0.247	0.500**	2.023***	0.301
	(0.579)	(0.169)	(0.305)	(0.862)
AY 2015-2016	-0.638	0.596**	1.598***	1.213
	(0.733)	(0.191)	(0.365)	(1.008)
AY 2016-2017	-0.742	0.614**	1.789***	1.310
	(0.921)	(0.197)	(0.396)	(1.182)
AY 2017-2018	-0.288	0.703**	1.958***	0.737
	(0.965)	(0.219)	(0.432)	(1.239)
AY 2018-2019	-0.457	1.140***	1.493**	1.205
	(1.062)	(0.258)	(0.475)	(1.329)
Constant	16.455*	7.925***	-15.404***	-2.550
	(7.561)	(2.100)	(4.240)	(10.934)
Sample Size	5931	5931	5931	5931
R-Squared	0.98	0.98	0.98	0.45
Fixed Effects vs. Pooled (F-Test)	1942.16***	1141.29***	5198.63***	459.51***
Fixed vs. Random Effects (χ^2)	278.84***	184.08***	194.78***	93.73***

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01, *** p<.001
[a] In hundreds, adjusted to 2018 dollars
[b] In thousands, adjusted to 2018 dollars

4.7: Fixed Effects Models Including State- and Institution-level Moderating Factors

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
Tuition Discount Rate	-0.102**	-0.046	-0.176*	-0.004	0.018	-0.038
	(0.037)	(0.045)	(0.070)	(0.027)	(0.036)	(0.037)
Pct: State Need-based Aid	-0.116	-0.077	-0.175	----	----	----
	(0.121)	(0.182)	(0.129)			
TDR*Pct spent in need	0.014**	0.009+	0.020**	----	----	----
	(0.004)	(0.005)	(0.007)			
Surplus Margin Ratio	----	----	----	-1.269	-3.515	1.682
				(2.492)	(4.647)	(2.778)
TDR*Surplus Margin	----	----	----	-0.004	0.127	-0.168
				(0.102)	(0.170)	(0.139)
Tuition/fee: In-state[a]	0.023	0.035+	0.008	0.026+	0.035+	0.018
	(0.015)	(0.018)	(0.029)	(0.014)	(0.018)	(0.029)
Tuition/fee: Out-of-state[a]	-0.005	-0.014	0.001	-0.006	-0.015	-0.001
	(0.007)	(0.010)	(0.011)	(0.007)	(0.010)	(0.011)
Avg Amt Grant from State/local Govt[b]	0.139	0.241	0.102	0.192+	0.291+	0.116
	(0.110)	(0.162)	(0.124)	(0.113)	(0.166)	(0.125)
Avg Amt of Federal Grant[b]	0.531+	0.433	0.840*	0.537+	0.447	0.861*
	(0.288)	(0.368)	(0.361)	(0.288)	(0.368)	(0.365)
Avg Amt of Loan[b]	-0.411	-0.300	-0.755*	-0.403	-0.296	-0.760*
	(0.253)	(0.314)	(0.340)	(0.252)	(0.313)	(0.345)
75th percentile SAT/ACT Math scores	-0.014*	-0.017*	-0.001	-0.013*	-0.017*	0.001
	(0.006)	(0.007)	(0.007)	(0.006)	(0.008)	(0.008)
No SAT Score	2.816***	1.742	3.340**	2.942***	1.835+	3.324**
	(0.717)	(1.092)	(1.029)	(0.726)	(1.088)	(1.087)

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
Acceptance Rate	-0.015	-0.043**	-0.030	-0.016	-0.043**	-0.027
	(0.011)	(0.016)	(0.045)	(0.011)	(0.016)	(0.044)
Personal Income per Capita	0.051	0.115	-0.022	0.075	0.136	0.009
	(0.090)	(0.111)	(0.158)	(0.094)	(0.114)	(0.160)
Unemployment Rate	-0.487*	-0.448+	-0.534*	-0.467*	-0.450+	-0.477+
	(0.191)	(0.268)	(0.253)	(0.191)	(0.266)	(0.256)
Poverty Rate	0.213**	0.327**	0.073	0.200**	0.313**	0.072
	(0.074)	(0.105)	(0.110)	(0.074)	(0.105)	(0.110)
Pct: Black Pop 18-24	63.378	131.830*	-54.831	46.771	122.806*	-75.885
	(40.853)	(53.774)	(62.461)	(41.330)	(53.902)	(59.792)
Pct: Hispanic Pop 18-24	184.869***	190.225***	157.789***	187.291***	193.887***	158.189***
	(19.990)	(29.302)	(29.030)	(19.828)	(28.235)	(29.125)
AY 2009-2010	4.559***	4.670***	4.245**	4.521***	4.664**	4.098**
	(0.999)	(1.409)	(1.339)	(0.997)	(1.421)	(1.347)
AY 2010-2011	2.036**	1.344	3.295***	2.085**	1.454	3.205**
	(0.668)	(0.941)	(0.988)	(0.660)	(0.928)	(1.000)
AY 2011-2012	2.825***	1.176	5.493***	2.938***	1.297	5.514***
	(0.636)	(0.834)	(0.998)	(0.638)	(0.831)	(1.007)
AY 2012-2013	2.965***	1.353+	5.623***	3.074***	1.450+	5.704***
	(0.645)	(0.803)	(0.993)	(0.659)	(0.813)	(0.987)
AY 2013-2014	2.755***	1.442	5.029***	2.958***	1.603+	5.203***
	(0.669)	(0.885)	(1.005)	(0.679)	(0.887)	(1.000)
AY 2014-2015	1.991**	0.599	4.673***	2.196**	0.736	4.902***
	(0.765)	(1.000)	(1.110)	(0.777)	(1.001)	(1.104)
AY 2015-2016	2.125*	1.061	4.411***	2.278**	1.108	4.642***
	(0.838)	(1.100)	(1.234)	(0.855)	(1.104)	(1.229)

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
AY 2016-2017	2.310**	1.271	4.828***	2.441**	1.279	5.083***
	(0.882)	(1.122)	(1.319)	(0.897)	(1.126)	(1.323)
AY 2017-2018	2.378*	1.689	4.536***	2.467**	1.656	4.726***
	(0.933)	(1.214)	(1.356)	(0.951)	(1.221)	(1.365)
AY 2018-2019	2.241*	1.771	4.424**	2.289*	1.732	4.552**
	(0.999)	(1.323)	(1.453)	(1.018)	(1.328)	(1.458)
Constant	-0.075	-14.811	20.192	-0.737	-15.621	17.284
	(9.616)	(13.225)	(13.930)	(9.797)	(13.335)	(13.679)
Sample Size	5931	3459	2472	5931	3459	2472
R-Squared	0.95	0.94	0.96	0.95	0.94	0.96
Fixed Effects vs. Pooled(F-Test)	1143.81***	947.08***	472.07***	1997.26***	1603.44***	1173.27***
Fixed vs. Random Effects (χ^2)	478.60***	519.56***	187.50***	471.67***	489.54***	188.94***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.8: The Relationship between Tuition Discounting and the Percentage of Low-income Students

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.096***	0.093***	0.077**	0.127***	0.000
	(0.026)	(0.025)	(0.025)	(0.031)	(0.036)
Tuition/fee: In-state[a]	0.017	0.014	0.010	0.029+	-0.008
	(0.013)	(0.013)	(0.013)	(0.016)	(0.025)
Tuition/fee: Out-of-state[a]	-0.010	-0.008	-0.008	-0.023*	0.008
	(0.007)	(0.007)	(0.007)	(0.009)	(0.010)
Avg Amt Grant from State/local Govt[b]	-0.147	-0.117	-0.129	-0.113	-0.277
	(0.123)	(0.124)	(0.125)	(0.157)	(0.179)
Avg Amt of Federal Grant[b]	0.242	0.243	0.300	0.432+	-0.097
	(0.205)	(0.202)	(0.203)	(0.249)	(0.387)
Avg Amt of Loan[b]	-0.267	-0.268	-0.309+	-0.441*	0.037
	(0.169)	(0.165)	(0.169)	(0.218)	(0.321)
75th percentile SAT/ACT Math scores		-0.016**	-0.015**	-0.024**	0.008
		(0.005)	(0.005)	(0.008)	(0.007)
No SAT Score		2.838***	2.625***	3.137***	1.181
		(0.562)	(0.550)	(0.797)	(0.732)
Acceptance Rate		0.020*	0.022*	0.027+	0.124***
		(0.010)	(0.010)	(0.015)	(0.036)
Personal Income per Capita			0.043	0.078	-0.156
			(0.087)	(0.106)	(0.132)
Unemployment Rate			-0.244+	0.035	-0.538**
			(0.130)	(0.177)	(0.203)
Poverty Rate			0.141**	0.016	0.224**
			(0.054)	(0.064)	(0.082)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			-91.910**	-59.506	-1.066
			(33.578)	(39.439)	(61.572)
Pct: Hispanic Pop 18-24			7.477	-23.159	42.393
			(19.636)	(23.465)	(29.949)
AY 2009-2010	0.014	0.045	0.887*	0.540	0.702
	(0.273)	(0.275)	(0.446)	(0.616)	(0.836)
AY 2010-2011	6.104***	6.259***	7.186***	6.273***	8.048***
	(0.349)	(0.353)	(0.536)	(0.730)	(0.918)
AY 2011-2012	11.100***	11.173***	12.179***	10.831***	13.655***
	(0.372)	(0.373)	(0.567)	(0.720)	(1.011)
AY 2012-2013	11.805***	11.882***	12.860***	11.594***	13.953***
	(0.390)	(0.390)	(0.582)	(0.702)	(1.097)
AY 2013-2014	10.420***	10.491***	11.576***	10.931***	11.532***
	(0.405)	(0.406)	(0.590)	(0.706)	(1.119)
AY 2014-2015	10.577***	10.556***	11.260***	11.034***	10.979***
	(0.421)	(0.419)	(0.637)	(0.733)	(1.163)
AY 2015-2016	10.547***	10.506***	11.085***	11.233***	10.571***
	(0.430)	(0.424)	(0.698)	(0.801)	(1.222)
AY 2016-2017	9.361***	9.311***	9.825***	10.442***	8.773***
	(0.447)	(0.439)	(0.722)	(0.857)	(1.238)
AY 2017-2018	8.811***	8.953***	9.243***	10.377***	7.616***
	(0.442)	(0.446)	(0.778)	(0.922)	(1.280)
AY 2018-2019	10.369***	10.521***	10.625***	12.456***	8.577***
	(0.468)	(0.478)	(0.859)	(1.034)	(1.372)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	32.905***	39.946***	50.116***	54.764***	20.027
	(1.309)	(3.402)	(8.571)	(10.762)	(12.600)
Sample Size	5931	5931	5931	3459	2472
R-Squared	0.94	0.94	0.94	0.96	0.93
Fixed Effects vs. Pooled (F-Test)	664.82***	421.70***	1472.88***	266.02***	254.27***
Fixed vs. Random Effects (χ^2)	440.81***	734.43***	1046.06***	784.18***	487.91***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.9: Fixed Effects Models Including State- and Institution-level Moderating Factors

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
Tuition Discount Rate	0.001	0.073	-0.081	0.077**	0.129***	-0.002
	(0.043)	(0.056)	(0.059)	(0.025)	(0.032)	(0.037)
Pct: State Need-based Aid	-0.266**	-0.352**	-0.068	----	----	----
	(0.101)	(0.136)	(0.143)			
TDR*Pct spent in need	0.011*	0.008	0.012+	----	----	----
	(0.004)	(0.005)	(0.007)			
Surplus Margin Ratio	----	----	----	-1.371	-0.505	-1.139
				(1.808)	(2.228)	(2.744)
TDR*Surplus Margin	----	----	----	-0.055	-0.156	0.050
				(0.097)	(0.100)	(0.183)
Tuition/fee: In-state[a]	0.012	0.034*	-0.015	0.010	0.029+	-0.008
	(0.013)	(0.016)	(0.025)	(0.013)	(0.016)	(0.025)
Tuition/fee: Out-of-state[a]	-0.007	-0.023*	0.009	-0.007	-0.023*	0.008
	(0.007)	(0.009)	(0.010)	(0.007)	(0.009)	(0.010)
Avg Amt Grant from State/local Govt[b]	-0.133	-0.079	-0.290	-0.131	-0.114	-0.277
	(0.125)	(0.155)	(0.178)	(0.125)	(0.157)	(0.179)
Avg Amt of Federal Grant[b]	0.294	0.417+	-0.098	0.303	0.415+	-0.098
	(0.201)	(0.240)	(0.387)	(0.203)	(0.246)	(0.378)
Avg Amt of Loan[b]	-0.302+	-0.441*	0.024	-0.310+	-0.429*	0.038
	(0.165)	(0.209)	(0.321)	(0.169)	(0.216)	(0.316)
75th percentile SAT/ACT Math scores	-0.016**	-0.025**	0.007	-0.015**	-0.024**	0.008
	(0.005)	(0.008)	(0.007)	(0.005)	(0.008)	(0.007)
No SAT Score	2.508***	3.046***	1.188	2.633***	3.172***	1.193
	(0.562)	(0.825)	(0.730)	(0.551)	(0.791)	(0.732)

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
Acceptance Rate	0.024*	0.028+	0.121***	0.022*	0.027+	0.124***
	(0.010)	(0.015)	(0.036)	(0.010)	(0.015)	(0.037)
Personal Income per Capita	0.002	0.022	-0.169	0.039	0.073	-0.156
	(0.085)	(0.102)	(0.134)	(0.087)	(0.106)	(0.132)
Unemployment Rate	-0.241+	0.031	-0.576**	-0.251+	0.016	-0.540**
	(0.128)	(0.174)	(0.201)	(0.130)	(0.176)	(0.204)
Poverty Rate	0.155**	0.037	0.224**	0.142**	0.018	0.225**
	(0.054)	(0.064)	(0.082)	(0.054)	(0.063)	(0.082)
Pct: Black Pop 18-24	-93.444**	-66.937+	15.818	-92.663**	-59.922	-1.366
	(33.643)	(38.471)	(63.606)	(33.649)	(39.469)	(61.677)
Pct: Hispanic Pop 18-24	12.172	-9.881	41.771	6.545	-23.961	41.736
	(19.545)	(23.689)	(30.129)	(19.624)	(23.380)	(29.992)
AY 2009-2010	0.812+	0.429	0.781	0.832+	0.456	0.710
	(0.444)	(0.606)	(0.836)	(0.446)	(0.621)	(0.826)
AY 2010-2011	7.081***	6.190***	8.120***	7.241***	6.371***	8.066***
	(0.535)	(0.714)	(0.932)	(0.539)	(0.727)	(0.917)
AY 2011-2012	12.152***	10.916***	13.642***	12.243***	10.943***	13.671***
	(0.565)	(0.714)	(1.016)	(0.568)	(0.715)	(1.011)
AY 2012-2013	12.892***	11.757***	13.868***	12.848***	11.582***	13.953***
	(0.581)	(0.696)	(1.095)	(0.582)	(0.698)	(1.084)
AY 2013-2014	11.515***	10.943***	11.379***	11.548***	10.894***	11.533***
	(0.587)	(0.687)	(1.122)	(0.587)	(0.703)	(1.097)
AY 2014-2015	11.223***	11.079***	10.789***	11.251***	11.038***	10.976***
	(0.631)	(0.714)	(1.160)	(0.637)	(0.732)	(1.139)
AY 2015-2016	11.146***	11.411***	10.362***	11.068***	11.189***	10.578***
	(0.694)	(0.790)	(1.208)	(0.697)	(0.800)	(1.201)

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
AY 2016-2017	9.860***	10.557***	8.560***	9.791***	10.351***	8.778***
	(0.717)	(0.842)	(1.224)	(0.721)	(0.853)	(1.223)
AY 2017-2018	9.298***	10.485***	7.429***	9.196***	10.255***	7.626***
	(0.773)	(0.911)	(1.265)	(0.776)	(0.918)	(1.263)
AY 2018-2019	10.721***	12.590***	8.421***	10.582***	12.352***	8.586***
	(0.854)	(1.025)	(1.352)	(0.859)	(1.033)	(1.359)
Constant	53.167***	58.496***	20.991	50.516***	55.346***	20.184
	(8.598)	(10.688)	(12.985)	(8.587)	(10.795)	(12.552)
Sample Size	5931	3459	2472	5931	3459	2472
R-Squared	0.94	0.96	0.93	0.94	0.96	0.93
Fixed Effects vs. Pooled(F-Test)	1330.10***	220.42***	356.38***	4583.63***	689.25***	287.72***
Fixed vs. Random Effects (χ^2)	1047.12***	808.97***	465.22***	1066.92***	815.32***	484.38***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.10: The Relationship between Tuition Discounting and the Percentage of Non-resident Students

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.039	0.039	0.025	-0.022	0.074
	(0.030)	(0.030)	(0.030)	(0.039)	(0.047)
Tuition/fee: In-state[a]	-0.016	-0.013	-0.009	-0.011	0.021
	(0.014)	(0.014)	(0.014)	(0.014)	(0.031)
Tuition/fee: Out-of-state[a]	0.019*	0.018*	0.018*	0.019*	0.011
	(0.008)	(0.009)	(0.009)	(0.008)	(0.017)
Avg Amt Grant from State/local Govt[b]	0.146	0.141	0.124	0.096	0.090
	(0.116)	(0.114)	(0.113)	(0.157)	(0.153)
Avg Amt of Federal Grant[b]	-0.728**	-0.732**	-0.786**	-0.410	-1.239*
	(0.274)	(0.275)	(0.273)	(0.343)	(0.557)
Avg Amt of Loan[b]	0.628**	0.624**	0.728***	0.471*	1.075*
	(0.222)	(0.221)	(0.216)	(0.229)	(0.500)
75th percentile SAT/ACT Math scores		0.003	0.002	0.002	-0.006
		(0.006)	(0.006)	(0.006)	(0.013)
No SAT Score		-1.050+	-1.146*	-0.367	-2.303+
		(0.577)	(0.561)	(0.512)	(1.195)
Acceptance Rate		-0.045**	-0.040**	-0.064**	-0.042
		(0.015)	(0.015)	(0.020)	(0.045)
Personal Income per Capita			0.191+	0.220+	0.228
			(0.102)	(0.128)	(0.154)
Unemployment Rate			-0.320*	-0.402*	-0.273
			(0.156)	(0.203)	(0.289)
Poverty Rate			-0.118+	-0.159+	-0.121
			(0.064)	(0.081)	(0.101)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			62.320	55.360	24.420
			(42.328)	(57.563)	(57.374)
Pct: Hispanic Pop 18-24			54.941**	77.419**	12.358
			(20.602)	(27.321)	(32.402)
AY 2009-2010	0.137	0.101	1.360*	1.534+	1.657
	(0.320)	(0.320)	(0.671)	(0.902)	(1.297)
AY 2010-2011	-0.516	-0.658+	0.394	0.706	0.121
	(0.358)	(0.354)	(0.725)	(1.032)	(1.224)
AY 2011-2012	-0.545	-0.638+	-0.356	-0.404	0.453
	(0.369)	(0.370)	(0.670)	(0.942)	(1.161)
AY 2012-2013	-0.176	-0.236	-0.559	-0.639	0.413
	(0.380)	(0.382)	(0.641)	(0.935)	(1.102)
AY 2013-2014	-0.372	-0.383	-1.081+	-1.130	-0.310
	(0.427)	(0.428)	(0.620)	(0.829)	(1.088)
AY 2014-2015	-0.113	-0.064	-1.467*	-1.976*	-0.237
	(0.437)	(0.437)	(0.627)	(0.815)	(1.118)
AY 2015-2016	-0.023	0.015	-2.264**	-2.873**	-1.048
	(0.463)	(0.461)	(0.746)	(0.959)	(1.352)
AY 2016-2017	0.243	0.331	-2.329**	-3.198**	-0.828
	(0.486)	(0.485)	(0.800)	(1.003)	(1.483)
AY 2017-2018	0.653	0.740	-2.336**	-3.265**	-0.743
	(0.502)	(0.485)	(0.863)	(1.048)	(1.557)
AY 2018-2019	0.218	0.347	-3.283***	-3.960***	-2.068
	(0.506)	(0.493)	(0.962)	(1.174)	(1.697)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	10.836***	12.800***	-11.213	-15.001	5.386
	(1.467)	(3.592)	(10.061)	(13.914)	(14.403)
Sample Size	5931	5931	5931	3459	2472
R-Squared	0.91	0.92	0.92	0.93	0.93
Fixed Effects vs. Pooled (F-Test)	398.65***	760.92***	3438.17***	1407.27***	942.87***
Fixed vs. Random Effects (χ^2)	123.47***	120.60***	135.62***	137.20***	64.45***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.11: Fixed Effects Models Including State- and Institution-level Moderating Factors

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
Tuition Discount Rate	0.108+	0.038	0.205*	0.026	-0.024	0.082+
	(0.063)	(0.081)	(0.103)	(0.032)	(0.040)	(0.049)
Pct: State Need-based Aid	0.192+	0.108	0.263*	----	----	----
	(0.103)	(0.153)	(0.127)			
TDR*Pct spent in need	-0.012*	-0.008	-0.020*	----	----	----
	(0.005)	(0.007)	(0.010)			
Surplus Margin Ratio	----	----	----	1.141	-0.202	4.556+
				(2.131)	(3.439)	(2.573)
TDR*Surplus Margin	----	----	----	-0.008	0.129	-0.285+
				(0.118)	(0.164)	(0.152)
Tuition/fee: In-state[a]	-0.010	-0.012	0.029	-0.010	-0.011	0.020
	(0.014)	(0.014)	(0.030)	(0.014)	(0.014)	(0.031)
Tuition/fee: Out-of-state[a]	0.017*	0.019*	0.009	0.018*	0.019*	0.012
	(0.008)	(0.008)	(0.017)	(0.009)	(0.008)	(0.017)
Avg Amt Grant from State/local Govt[b]	0.148	0.128	0.095	0.124	0.096	0.090
	(0.112)	(0.159)	(0.147)	(0.112)	(0.157)	(0.151)
Avg Amt of Federal Grant[b]	-0.782**	-0.406	-1.241*	-0.790**	-0.397	-1.218*
	(0.269)	(0.338)	(0.554)	(0.274)	(0.337)	(0.538)
Avg Amt of Loan[b]	0.729***	0.477*	1.087*	0.729***	0.462*	1.051*
	(0.215)	(0.229)	(0.500)	(0.217)	(0.232)	(0.483)
75th percentile SAT/ACT Math scores	0.003	0.002	-0.003	0.002	0.002	-0.005
	(0.006)	(0.006)	(0.012)	(0.006)	(0.006)	(0.013)
No SAT Score	-1.032+	-0.278	-2.274*	-1.150*	-0.393	-2.353+
	(0.551)	(0.498)	(1.156)	(0.562)	(0.504)	(1.199)

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
Acceptance Rate	-0.040**	-0.064**	-0.038	-0.039**	-0.064**	-0.043
	(0.015)	(0.020)	(0.046)	(0.015)	(0.020)	(0.045)
Personal Income per Capita	0.224*	0.247+	0.264+	0.192+	0.222+	0.231
	(0.107)	(0.138)	(0.155)	(0.102)	(0.127)	(0.154)
Unemployment Rate	-0.311*	-0.398*	-0.242	-0.316*	-0.390+	-0.262
	(0.156)	(0.202)	(0.287)	(0.156)	(0.202)	(0.288)
Poverty Rate	-0.131*	-0.173*	-0.120	-0.119+	-0.160*	-0.126
	(0.066)	(0.084)	(0.101)	(0.064)	(0.081)	(0.102)
Pct: Black Pop 18-24	56.310	50.531	13.225	62.803	55.457	25.533
	(44.523)	(59.080)	(60.628)	(42.263)	(56.998)	(57.717)
Pct: Hispanic Pop 18-24	53.725*	78.535**	9.277	55.440**	77.930**	15.048
	(21.340)	(28.151)	(32.813)	(20.623)	(27.268)	(32.411)
AY 2009-2010	1.398*	1.589+	1.590	1.386*	1.583+	1.598
	(0.679)	(0.929)	(1.281)	(0.673)	(0.908)	(1.284)
AY 2010-2011	0.457	0.767	0.139	0.368	0.645	0.051
	(0.735)	(1.059)	(1.240)	(0.725)	(1.026)	(1.220)
AY 2011-2012	-0.310	-0.364	0.519	-0.386	-0.474	0.392
	(0.672)	(0.956)	(1.150)	(0.668)	(0.928)	(1.161)
AY 2012-2013	-0.527	-0.596	0.494	-0.555	-0.630	0.380
	(0.644)	(0.955)	(1.074)	(0.641)	(0.931)	(1.097)
AY 2013-2014	-0.956	-1.009	-0.142	-1.071+	-1.104	-0.355
	(0.625)	(0.863)	(1.051)	(0.622)	(0.830)	(1.088)
AY 2014-2015	-1.358*	-1.894*	-0.029	-1.465*	-1.976*	-0.271
	(0.635)	(0.834)	(1.091)	(0.628)	(0.809)	(1.119)
AY 2015-2016	-2.230**	-2.870**	-0.856	-2.262**	-2.841**	-1.116
	(0.757)	(0.976)	(1.324)	(0.748)	(0.960)	(1.360)

	State Grants on Need			Inst. Financial Health		
Variable	**All**	**More selective**	**Less selective**	**All**	**More selective**	**Less selective**
AY 2016-2017	-2.285**	-3.206**	-0.610	-2.319**	-3.135**	-0.884
	(0.801)	(1.010)	(1.444)	(0.803)	(1.011)	(1.488)
AY 2017-2018	-2.318**	-3.293**	-0.566	-2.322**	-3.182**	-0.831
	(0.864)	(1.053)	(1.522)	(0.866)	(1.060)	(1.566)
AY 2018-2019	-3.307***	-4.013***	-1.950	-3.272***	-3.887**	-2.162
	(0.964)	(1.181)	(1.669)	(0.965)	(1.180)	(1.706)
Constant	-13.240	-16.453	1.632	-11.430	-15.340	4.594
	(10.485)	(14.357)	(14.819)	(10.036)	(13.767)	(14.380)
Sample Size	5931	3459	2472	5931	3459	2472
R-Squared	0.92	0.92	0.93	0.92	0.93	0.93
Fixed Effects vs. Pooled(F-Test)	281.92***	278.61***	749.04***	3604.79***	1637.47***	1736.38***
Fixed vs. Random Effects (χ^2)	145.40***	142.46***	74.73***	138.86***	138.11***	67.26***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Table 4.12 Descriptive Statistics for Variables Used in Regression Models (Year=2014)

	N	Mean	SD	Min	Max
Tuition Discount	395	16.36	8.89	0.00	52.40
Share of Inst. Need-based Grants	395	0.56	0.31	0.00	1.00
Full-time Undergraduate Enrollment[a]	395	101.88	82.21	3.53	420.17
Full-time Freshmen Enrollment[a]	395	21.21	17.45	0.90	94.89
Percent: URM	395	35.52	21.83	3.33	98.99
Percent: Pell-recipients	395	40.01	15.27	10.00	82.00
Percent: Non-resident	395	15.70	14.58	0.00	76.00
Percent: White	395	59.08	23.86	1.01	95.56
Percent: Black	395	13.42	19.18	0.00	96.36
Percent: Hispanic	395	12.63	15.03	0.20	94.74
Percent: Asian	395	5.40	7.57	0.00	39.57
Percent: Other races	395	9.30	5.74	0.47	49.45
Percent: State's Need-based Grants	395	7.51	5.09	0.00	21.60
Surplus Margin[b]	395	0.04	0.07	-0.11	0.37
Tuition/fee: In-state[c]	395	72.76	27.75	0.74	155.39
Tuition/fee: Out-of-state[c]	395	192.00	71.56	0.74	473.38
Avg Amt Grant from State/local Govt[d]	395	3471.30	2043.42	481.00	10557.00
Avg Amt of Federal Grant[d]	395	5567.77	711.93	3460.00	9141.00
Avg Amt of Loan[d]	395	6490.39	1114.49	3569.00	10328.00
75th percentile SAT/ACT Math scores	395	587.74	62.37	445.00	790.00
No SAT Score	395	0.10	0.31	0.00	1.00
Acceptance Rate	395	71.35	17.78	17.00	100.00
Personal Income per Capita[e]	395	49.33	7.06	36.92	69.77
Poverty Rate	395	14.44	3.34	7.20	23.10
Unemployment Rate	395	5.98	1.03	2.70	7.90
Percent: URM Pop 18-24	395	38.66	15.99	8.50	70.59
Pct Black ages 18-24	395	0.16	0.10	0.01	0.44
Pct Hispanic ages 18-24	395	0.17	0.14	0.02	0.55
N	395	16.36	8.89	0.00	52.40

[a] In hundreds
[b] As a proportion to total revenue
[c] In hundreds, adjusted to 2018 dollars
[d] In thousands, adjusted to 2018 dollars
[e] Total amount was divided by state's population ages 18-24

4.13: The Relationship between Share of Institutional Need-based Grants and Full-time Undergraduate Enrollment

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.161+	0.149	0.038	0.063	-0.010
	(0.092)	(0.092)	(0.084)	(0.106)	(0.095)
Share of Inst. Need-based Grants	1.027	1.201	0.099	-0.184	-2.536
	(1.861)	(1.826)	(1.738)	(2.498)	(2.531)
Tuition/fee: In-state[a]	-0.120**	-0.118**	-0.131**	-0.189***	0.033
	(0.044)	(0.043)	(0.043)	(0.055)	(0.085)
Tuition/fee: Out-of-state[a]	0.115***	0.111***	0.114***	0.143***	0.019
	(0.025)	(0.025)	(0.025)	(0.035)	(0.028)
Avg Amt Grant from State/local Govt[b]	-0.469	-0.479	-0.792*	-1.066**	-0.881
	(0.340)	(0.338)	(0.335)	(0.410)	(0.554)
Avg Amt of Federal Grant[b]	-0.214	-0.189	-0.562	-0.876	-0.561
	(1.199)	(1.196)	(1.260)	(1.563)	(1.484)
Avg Amt of Loan[b]	0.196	0.183	0.605	0.228	1.172
	(0.904)	(0.898)	(0.956)	(1.143)	(1.216)
75th percentile SAT/ACT Math scores		0.025+	0.026+	0.039**	-0.045
		(0.014)	(0.014)	(0.014)	(0.033)
No SAT Score		3.356	2.252	-1.968	5.105*
		(2.400)	(2.137)	(2.361)	(2.095)
Acceptance Rate		-0.033	-0.002	-0.020	0.186
		(0.034)	(0.030)	(0.053)	(0.115)
Personal Income per Capita			0.273	0.337	0.265
			(0.280)	(0.321)	(0.437)
Unemployment Rate			-1.005*	-0.971+	0.142
			(0.443)	(0.563)	(0.812)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Poverty Rate			-0.164	-0.005	-0.256
			(0.190)	(0.248)	(0.304)
Pct: Black Pop 18-24			-244.221*	-109.618	246.845
			(118.623)	(154.710)	(259.151)
Pct: Hispanic Pop 18-24			304.872**	475.131***	85.604
			(107.220)	(110.445)	(274.836)
AY 2009-2010	3.284***	3.247***	6.818***	6.342**	3.475
	(0.686)	(0.687)	(1.660)	(2.194)	(2.344)
AY 2010-2011	5.633***	5.558***	8.865***	7.363**	5.778*
	(0.817)	(0.816)	(1.888)	(2.435)	(2.819)
AY 2011-2012	7.106***	7.095***	9.699***	7.763**	5.612+
	(0.907)	(0.904)	(1.896)	(2.476)	(2.961)
AY 2012-2013	7.386***	7.402***	9.142***	7.111**	3.969
	(0.962)	(0.953)	(1.955)	(2.504)	(3.561)
AY 2013-2014	7.179***	7.269***	8.280***	6.691*	1.479
	(1.096)	(1.087)	(2.010)	(2.597)	(3.772)
AY 2014-2015	7.860***	7.912***	6.800**	5.277*	0.975
	(1.166)	(1.163)	(2.149)	(2.683)	(4.661)
AY 2015-2016	8.560***	8.564***	5.059*	3.611	0.547
	(1.310)	(1.304)	(2.517)	(3.197)	(5.310)
AY 2016-2017	9.684***	9.811***	4.629+	2.980	0.849
	(1.450)	(1.456)	(2.763)	(3.512)	(5.976)
AY 2017-2018	10.949***	10.651***	3.628	2.183	1.598
	(1.540)	(1.490)	(2.921)	(3.609)	(6.668)
AY 2018-2019	11.566***	11.256***	2.005	0.860	0.022
	(1.788)	(1.734)	(3.234)	(4.026)	(7.127)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	81.750***	69.412***	52.954+	1.265	32.065
	(5.054)	(9.542)	(28.448)	(38.945)	(49.163)
Sample Size	4005	4005	4005	2685	1320
R-Squared	0.99	0.99	0.99	0.99	0.99
Fixed Effects vs. Pooled (F-Test)	165.08***	587.38***	2672.72***	962.38***	1556.90***
Fixed vs. Random Effects (χ^2)	198.16***	235.19***	296.75***	165.94***	119.80***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.14: The Relationship between Share of Institutional Need-based Grants and Full-time Freshmen Enrollment

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.023	0.021	-0.006	-0.008	-0.006
	(0.021)	(0.021)	(0.022)	(0.028)	(0.025)
Share of Inst. Need-based Grants	0.048	0.088	-0.159	-0.158	-0.624
	(0.461)	(0.456)	(0.437)	(0.598)	(0.484)
Tuition/fee: In-state[a]	-0.033**	-0.032**	-0.035**	-0.046***	-0.020
	(0.011)	(0.011)	(0.011)	(0.014)	(0.016)
Tuition/fee: Out-of-state[a]	0.027***	0.026***	0.027***	0.033***	0.009+
	(0.005)	(0.005)	(0.006)	(0.008)	(0.005)
Avg Amt Grant from State/local Govt[b]	-0.034	-0.035	-0.113	-0.105	-0.145
	(0.098)	(0.098)	(0.094)	(0.125)	(0.120)
Avg Amt of Federal Grant[b]	-0.286	-0.277	-0.372	-0.548	-0.393
	(0.257)	(0.257)	(0.272)	(0.350)	(0.313)
Avg Amt of Loan[b]	0.271	0.268	0.374*	0.367+	0.545*
	(0.182)	(0.181)	(0.190)	(0.216)	(0.255)
75th percentile SAT/ACT Math scores		0.006+	0.006+	0.006	-0.005
		(0.003)	(0.003)	(0.004)	(0.005)
No SAT Score		0.695	0.439	-0.262	1.208+
		(0.675)	(0.621)	(0.645)	(0.708)
Acceptance Rate		0.000	0.008	0.006	0.041
		(0.008)	(0.007)	(0.011)	(0.026)
Personal Income per Capita			0.108+	0.133	0.041
			(0.063)	(0.082)	(0.075)
Unemployment Rate			-0.197+	-0.150	0.003
			(0.116)	(0.156)	(0.189)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Poverty Rate			-0.041	-0.027	-0.042
			(0.049)	(0.063)	(0.074)
Pct: Black Pop 18-24			-46.345	-20.966	69.039
			(31.176)	(40.401)	(57.585)
Pct: Hispanic Pop 18-24			75.267**	105.362***	70.110+
			(22.790)	(27.914)	(41.583)
AY 2009-2010	0.142	0.140	0.905*	0.738	0.012
	(0.182)	(0.183)	(0.438)	(0.618)	(0.583)
AY 2010-2011	0.425+	0.425+	1.066*	0.772	-0.086
	(0.218)	(0.216)	(0.486)	(0.682)	(0.655)
AY 2011-2012	0.912***	0.924***	1.319**	0.922	0.033
	(0.236)	(0.234)	(0.487)	(0.665)	(0.739)
AY 2012-2013	0.892***	0.903***	1.069*	0.741	-0.480
	(0.253)	(0.249)	(0.489)	(0.656)	(0.854)
AY 2013-2014	1.141***	1.161***	1.179*	0.936	-0.834
	(0.276)	(0.273)	(0.492)	(0.630)	(0.931)
AY 2014-2015	1.416***	1.423***	0.917+	0.809	-1.017
	(0.280)	(0.278)	(0.511)	(0.613)	(1.053)
AY 2015-2016	1.696***	1.699***	0.575	0.301	-0.944
	(0.309)	(0.306)	(0.596)	(0.735)	(1.158)
AY 2016-2017	1.979***	1.997***	0.480	0.236	-1.047
	(0.356)	(0.355)	(0.653)	(0.822)	(1.292)
AY 2017-2018	2.399***	2.317***	0.359	0.248	-1.054
	(0.365)	(0.360)	(0.692)	(0.874)	(1.361)
AY 2018-2019	2.821***	2.729***	0.215	0.297	-1.287
	(0.417)	(0.411)	(0.758)	(0.955)	(1.461)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	17.108***	13.811***	5.574	-3.989	-2.257
	(1.222)	(2.290)	(7.093)	(9.794)	(10.882)
Sample Size	4005	4005	4005	2685	1320
R-Squared	0.98	0.98	0.98	0.98	0.99
Fixed Effects vs. Pooled (F-Test)	129.57***	755.34***	1981.83***	514.94***	907.64***
Fixed vs. Random Effects (χ^2)	171.33***	206.84***	250.98***	132.99***	149.28***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.15: The Relationship between Share of Institutional Need-based Grants and the Percentage of Underrepresented Minority Students

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.063	0.055	0.020	0.022	0.030
	(0.040)	(0.040)	(0.039)	(0.050)	(0.047)
Share of Inst. Need-based Grants	1.861*	1.846*	1.420+	0.387	2.548**
	(0.895)	(0.876)	(0.812)	(1.102)	(0.957)
Tuition/fee: In-state[a]	0.031+	0.031+	0.029+	0.031	0.043
	(0.017)	(0.018)	(0.017)	(0.020)	(0.031)
Tuition/fee: Out-of-state[a]	-0.015	-0.015+	-0.015+	-0.018+	-0.021*
	(0.009)	(0.009)	(0.008)	(0.011)	(0.009)
Avg Amt Grant from State/local Govt[b]	0.133	0.147	0.027	0.136	-0.005
	(0.160)	(0.159)	(0.143)	(0.191)	(0.165)
Avg Amt of Federal Grant[b]	1.371***	1.347***	1.098**	0.970*	0.672
	(0.354)	(0.353)	(0.343)	(0.398)	(0.475)
Avg Amt of Loan[b]	-1.143***	-1.139***	-0.917***	-0.959**	-0.345
	(0.285)	(0.286)	(0.267)	(0.306)	(0.392)
75th percentile SAT/ACT Math scores		-0.004	-0.006	-0.008	0.008
		(0.008)	(0.007)	(0.010)	(0.008)
No SAT Score		2.790**	2.427**	1.696	2.881**
		(0.918)	(0.926)	(1.623)	(0.928)
Acceptance Rate		-0.024	-0.009	-0.031	0.042
		(0.017)	(0.016)	(0.024)	(0.037)
Personal Income per Capita			0.194+	0.127	0.278
			(0.116)	(0.151)	(0.189)
Unemployment Rate			-0.277	-0.430	-0.011
			(0.237)	(0.313)	(0.283)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Poverty Rate			0.216*	0.319*	0.043
			(0.089)	(0.128)	(0.093)
Pct: Black Pop 18-24			72.576	171.572*	-125.016*
			(53.733)	(66.651)	(60.970)
Pct: Hispanic Pop 18-24			205.246***	222.954***	163.848***
			(25.574)	(34.970)	(28.284)
AY 2009-2010	3.051***	3.050***	3.455**	4.402**	1.308
	(0.737)	(0.734)	(1.146)	(1.602)	(1.020)
AY 2010-2011	2.110***	2.131***	1.547+	1.470	2.112+
	(0.532)	(0.552)	(0.839)	(1.168)	(1.086)
AY 2011-2012	3.452***	3.448***	1.937*	1.155	3.909***
	(0.509)	(0.520)	(0.827)	(1.058)	(1.124)
AY 2012-2013	4.714***	4.756***	2.436**	1.482	4.722***
	(0.507)	(0.515)	(0.863)	(1.042)	(1.095)
AY 2013-2014	5.326***	5.399***	2.658**	1.432	5.100***
	(0.517)	(0.518)	(0.917)	(1.155)	(1.190)
AY 2014-2015	5.730***	5.752***	1.881+	0.480	4.937***
	(0.540)	(0.535)	(1.054)	(1.294)	(1.332)
AY 2015-2016	6.855***	6.825***	2.103+	1.125	4.407**
	(0.541)	(0.534)	(1.134)	(1.360)	(1.489)
AY 2016-2017	7.383***	7.417***	2.089+	1.303	4.479**
	(0.576)	(0.563)	(1.163)	(1.379)	(1.445)
AY 2017-2018	8.132***	8.249***	2.258+	1.698	4.163**
	(0.593)	(0.613)	(1.259)	(1.505)	(1.563)
AY 2018-2019	8.762***	8.898***	2.111	1.685	3.726*
	(0.620)	(0.642)	(1.326)	(1.609)	(1.597)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	26.683***	30.917***	-20.870+	-35.606*	-5.791
	(2.110)	(4.921)	(12.062)	(15.846)	(13.983)
Sample Size	4005	4005	4005	2685	1320
R-Squared	0.94	0.94	0.94	0.92	0.98
Fixed Effects vs. Pooled (F-Test)	1266.06***	851.33***	1948.66***	295.89***	253.57***
Fixed vs. Random Effects (χ^2)	163.57***	376.48***	388.24***	372.59***	127.64***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.16: The Relationship between Share of Institutional Need-based Grants and the Percentage of Low-income Students

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.135***	0.130***	0.113***	0.132***	0.051
	(0.026)	(0.025)	(0.025)	(0.029)	(0.045)
Share of Inst. Need-based Grants	1.341	1.266	1.221	2.052*	-0.086
	(0.835)	(0.819)	(0.806)	(0.983)	(1.266)
Tuition/fee: In-state[a]	0.041**	0.037**	0.034**	0.054***	0.013
	(0.013)	(0.013)	(0.013)	(0.014)	(0.027)
Tuition/fee: Out-of-state[a]	-0.021**	-0.020**	-0.019**	-0.037***	0.009
	(0.007)	(0.007)	(0.007)	(0.008)	(0.015)
Avg Amt Grant from State/local Govt[b]	-0.342*	-0.309*	-0.340*	-0.244	-0.538**
	(0.136)	(0.136)	(0.134)	(0.166)	(0.202)
Avg Amt of Federal Grant[b]	0.645*	0.624*	0.663*	0.464	0.891
	(0.304)	(0.299)	(0.304)	(0.357)	(0.600)
Avg Amt of Loan[b]	-0.474+	-0.463+	-0.479*	-0.502+	-0.491
	(0.244)	(0.238)	(0.244)	(0.298)	(0.415)
75th percentile SAT/ACT Math scores		-0.015**	-0.014*	-0.019*	0.008
		(0.006)	(0.006)	(0.008)	(0.007)
No SAT Score		2.275***	2.168***	2.823**	0.749
		(0.679)	(0.652)	(1.031)	(0.785)
Acceptance Rate		0.029**	0.029**	0.033*	0.097*
		(0.011)	(0.011)	(0.015)	(0.042)
Personal Income per Capita			0.151	0.099	0.160
			(0.093)	(0.117)	(0.142)
Unemployment Rate			-0.097	-0.013	-0.375
			(0.146)	(0.195)	(0.240)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Poverty Rate			0.100+	-0.003	0.217*
			(0.059)	(0.071)	(0.091)
Pct: Black Pop 18-24			-69.921+	-25.640	-47.035
			(39.772)	(49.265)	(75.831)
Pct: Hispanic Pop 18-24			-1.664	-21.524	-0.243
			(22.364)	(27.533)	(43.150)
AY 2009-2010	-0.064	-0.010	0.598	0.637	0.828
	(0.333)	(0.335)	(0.511)	(0.698)	(0.933)
AY 2010-2011	5.493***	5.656***	6.300***	6.058***	7.022***
	(0.389)	(0.394)	(0.595)	(0.813)	(1.019)
AY 2011-2012	10.092***	10.183***	10.760***	10.331***	11.690***
	(0.412)	(0.416)	(0.605)	(0.783)	(1.156)
AY 2012-2013	10.357***	10.454***	11.026***	10.742***	11.387***
	(0.443)	(0.444)	(0.637)	(0.770)	(1.298)
AY 2013-2014	9.666***	9.735***	10.491***	10.164***	10.542***
	(0.447)	(0.449)	(0.653)	(0.794)	(1.315)
AY 2014-2015	9.733***	9.721***	10.152***	10.308***	9.463***
	(0.467)	(0.466)	(0.718)	(0.837)	(1.519)
AY 2015-2016	9.811***	9.782***	9.972***	10.399***	9.051***
	(0.487)	(0.481)	(0.795)	(0.942)	(1.613)
AY 2016-2017	8.912***	8.848***	9.021***	9.612***	8.079***
	(0.514)	(0.506)	(0.842)	(1.024)	(1.611)
AY 2017-2018	8.775***	8.936***	8.907***	9.695***	7.384***
	(0.510)	(0.507)	(0.885)	(1.071)	(1.690)
AY 2018-2019	10.407***	10.550***	10.279***	11.249***	8.654***
	(0.578)	(0.577)	(0.981)	(1.224)	(1.765)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	28.214***	34.702***	37.276***	42.176***	12.205
	(1.824)	(3.920)	(9.112)	(11.873)	(13.562)
Sample Size	4005	4005	4005	2685	1320
R-Squared	0.95	0.95	0.95	0.96	0.95
Fixed Effects vs. Pooled (F-Test)	783.63***	483.66***	165.14***	170.71***	150.45***
Fixed vs. Random Effects (χ^2)	392.75***	604.33***	830.70***	604.48***	432.80***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

4.17: The Relationship between Share of Institutional Need-based Grants and the Percentage of Non-resident Students

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.030	0.030	0.013	-0.034	0.091
	(0.029)	(0.030)	(0.032)	(0.040)	(0.061)
Share of Inst. Need-based Grants	-0.106	-0.044	-0.338	-0.232	0.244
	(0.600)	(0.591)	(0.574)	(0.660)	(1.099)
Tuition/fee: In-state[a]	-0.022	-0.019	-0.016	-0.003	-0.020
	(0.014)	(0.014)	(0.014)	(0.013)	(0.037)
Tuition/fee: Out-of-state[a]	0.018*	0.016*	0.017*	0.013+	0.012
	(0.008)	(0.008)	(0.008)	(0.007)	(0.016)
Avg Amt Grant from State/local Govt[b]	0.235+	0.212	0.189	0.105	0.397+
	(0.142)	(0.140)	(0.137)	(0.171)	(0.234)
Avg Amt of Federal Grant[b]	-0.742+	-0.736+	-0.803+	-0.278	-1.362
	(0.442)	(0.446)	(0.435)	(0.487)	(0.882)
Avg Amt of Loan[b]	0.480	0.473	0.602*	0.176	1.315+
	(0.309)	(0.310)	(0.300)	(0.269)	(0.752)
75th percentile SAT/ACT Math scores		0.012+	0.010	0.012	0.014
		(0.006)	(0.006)	(0.008)	(0.009)
No SAT Score		-0.500	-0.512	-0.350	-0.990
		(0.609)	(0.599)	(0.650)	(0.839)
Acceptance Rate		-0.042***	-0.033**	-0.042*	-0.010
		(0.013)	(0.012)	(0.019)	(0.050)
Personal Income per Capita			0.166	0.171	0.210
			(0.125)	(0.135)	(0.255)
Unemployment Rate			-0.583***	-0.418*	-0.838**
			(0.157)	(0.209)	(0.253)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Poverty Rate			0.016	-0.001	-0.047
			(0.068)	(0.075)	(0.146)
Pct: Black Pop 18-24			79.242	55.712	102.020
			(52.592)	(66.383)	(86.693)
Pct: Hispanic Pop 18-24			65.232*	65.346+	55.596
			(26.644)	(33.527)	(47.612)
AY 2009-2010	0.578	0.525	2.452***	1.647+	3.848*
	(0.453)	(0.452)	(0.716)	(0.884)	(1.516)
AY 2010-2011	0.029	-0.116	1.550*	0.799	2.991+
	(0.476)	(0.475)	(0.780)	(1.012)	(1.521)
AY 2011-2012	0.292	0.202	0.841	0.012	2.739+
	(0.484)	(0.481)	(0.772)	(1.024)	(1.502)
AY 2012-2013	0.693	0.624	0.393	-0.201	1.895
	(0.497)	(0.494)	(0.778)	(1.057)	(1.598)
AY 2013-2014	0.691	0.669	-0.066	-0.388	0.830
	(0.533)	(0.529)	(0.742)	(0.940)	(1.606)
AY 2014-2015	1.059*	1.085*	-0.725	-1.031	0.312
	(0.534)	(0.531)	(0.756)	(0.946)	(1.565)
AY 2015-2016	0.982+	0.992+	-1.751*	-1.789+	-1.146
	(0.552)	(0.547)	(0.858)	(1.055)	(1.834)
AY 2016-2017	1.260*	1.342*	-1.804*	-1.730	-1.230
	(0.549)	(0.550)	(0.878)	(1.070)	(1.918)
AY 2017-2018	1.313*	1.228*	-2.373*	-2.374*	-1.779
	(0.571)	(0.578)	(0.943)	(1.134)	(1.967)
AY 2018-2019	1.057+	0.999	-3.153**	-2.766*	-2.996
	(0.591)	(0.609)	(1.025)	(1.233)	(2.095)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	12.677***	8.936*	-17.460	-18.024	-18.750
	(1.878)	(4.281)	(11.984)	(14.759)	(17.934)
Sample Size	4005	4005	4005	2685	1320
R-Squared	0.93	0.93	0.93	0.95	0.95
Fixed Effects vs. Pooled (F-Test)	501.76***	410.12***	1701.81***	903.61***	262.66***
Fixed vs. Random Effects (χ^2)	89.56***	95.22***	95.39***	103.77***	58.09***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollar

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Appendix A.1: Summary Table of the Relationship between Tuition Discounting and Student Enrollment Outcomes

Variables	M1	M2	M3	More Selective	Less Selective
FTE Enrollment	+	+			
FTFT Enrollment	+				
URM					
Black			–		
Asian					
Hispanic			+		
Others					
Low-income	+	+	+	+	
Non-resident					

Notes. All the coefficients that were statistically significant at the 0.1 level or below are presented here as either + or –. + represents statistically significantly positive relationship between tuition discount rate and student enrollment outcomes, whereas – represents statistically significantly negative relationship between tuition discount rate and student enrollment outcomes.

Appendix A.2: Summary Table of the Relationship between Tuition Discounting and Student Enrollment Outcomes

	State Grants on Need			Inst. Financial Health		
Variables	All	More selective	Less selective	All	More selective	Less selective
URM	+	+	+			
Low-income	+		+			
Non-resident	–		–			-

Notes. All the coefficients that were statistically significant at the 0.1 level or below are presented here as either + or –. + represents statistically significantly positive relationship between tuition discount rate and student enrollment outcomes, whereas – represents statistically significantly negative relationship between tuition discount rate and student enrollment outcomes.

Appendix A.3: Summary Table of the Relationship between Share of Need-based Institutional Grants and Student Enrollment Outcomes

Variables	M1	M2	M3	More Selective	Less Selective
FTE Enrollment					
FTFT Enrollment					
URM	+	+	+		+
Low-income				+	
Non-resident					

Notes. All the coefficients that were statistically significant at the 0.1 level or below are presented here as either + or –. + represents statistically significantly positive relationship between tuition discount rate and student enrollment outcomes, whereas – represents statistically significantly negative relationship between tuition discount rate and student enrollment outcomes.

Appendix B.1: The Relationship between Tuition Discounting and Full-time Undergraduate Enrollment Excluding Computed Observations

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.181*	0.171*	0.090	0.087	0.009
	(0.070)	(0.069)	(0.060)	(0.082)	(0.060)
Tuition/fee: In-state[a]	-0.073+	-0.070+	-0.078*	-0.153**	0.019
	(0.038)	(0.037)	(0.037)	(0.048)	(0.055)
Tuition/fee: Out-of-state[a]	0.105***	0.102***	0.104***	0.132***	0.043*
	(0.021)	(0.020)	(0.021)	(0.030)	(0.020)
Avg Amt Grant from State/local Govt[b]	-0.163	-0.178	-0.294	-0.461	-0.549
	(0.268)	(0.266)	(0.258)	(0.335)	(0.426)
Avg Amt of Federal Grant[b]	-0.348	-0.336	-0.429	-0.669	-0.190
	(0.705)	(0.702)	(0.735)	(0.938)	(0.939)
Avg Amt of Loan[b]	0.528	0.532	0.688	0.535	0.671
	(0.585)	(0.581)	(0.621)	(0.743)	(0.841)
75th percentile SAT/ACT Math scores		0.028**	0.029**	0.024*	-0.028
		(0.009)	(0.009)	(0.010)	(0.020)
No SAT Score		1.557	0.895	-1.427+	3.181*
		(0.985)	(0.890)	(0.818)	(1.506)
Acceptance Rate		-0.033	-0.014	-0.029	0.087
		(0.025)	(0.022)	(0.041)	(0.084)
Personal Income per Capita			0.460*	0.584*	0.241
			(0.204)	(0.270)	(0.221)
Unemployment Rate			-0.784*	-1.240*	0.518
			(0.357)	(0.484)	(0.516)
Poverty Rate			-0.259+	-0.095	-0.239
			(0.143)	(0.196)	(0.147)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			-191.082*	-67.559	167.076
			(82.878)	(115.101)	(147.566)
Pct: Hispanic Pop 18-24			210.121**	459.671***	10.475
			(69.817)	(88.243)	(113.132)
AY 2009-2010	2.684***	2.683***	6.468***	6.949***	3.187+
	(0.502)	(0.509)	(1.241)	(1.716)	(1.673)
AY 2010-2011	3.990***	3.545***	6.808***	7.780***	3.274+
	(0.472)	(0.508)	(1.339)	(1.907)	(1.827)
AY 2011-2012	5.600***	5.585***	7.935***	6.822***	4.460**
	(0.550)	(0.552)	(1.307)	(1.872)	(1.626)
AY 2012-2013	5.524***	5.554***	7.189***	5.712**	3.301+
	(0.598)	(0.595)	(1.334)	(1.896)	(1.875)
AY 2013-2014	4.984***	5.049***	6.217***	4.867*	1.716
	(0.694)	(0.694)	(1.369)	(1.951)	(1.988)
AY 2014-2015	5.301***	5.352***	4.705**	2.701	1.562
	(0.759)	(0.761)	(1.495)	(2.057)	(2.474)
AY 2015-2016	5.451***	5.511***	2.545	0.104	0.949
	(0.851)	(0.855)	(1.778)	(2.490)	(2.923)
AY 2016-2017	5.889***	6.009***	1.690	-1.059	0.868
	(0.948)	(0.957)	(1.939)	(2.726)	(3.306)
AY 2017-2018	6.664***	6.406***	0.474	-2.265	1.274
	(1.014)	(0.987)	(2.090)	(2.829)	(3.712)
AY 2018-2019	6.664***	6.391***	-1.479	-4.378	0.593
	(1.117)	(1.086)	(2.348)	(3.082)	(4.070)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	64.958***	51.229***	32.716	-15.118	24.967
	(3.323)	(6.190)	(21.109)	(32.133)	(31.559)
Sample Size	5761	5761	5761	3353	2408
R-Squared	0.99	0.99	0.99	0.99	0.99
Fixed Effects vs. Pooled (F-Test)	227.91***	444.51***	3063.89***	862.01***	1304.02***
Fixed vs. Random Effects (χ^2)	241.97***	323.71***	373.82***	213.29***	178.28***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix B.2: The Relationship between Tuition Discounting and Full-time Freshmen Enrollment Excluding Computed Observations

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.028+	0.026	0.008	-0.000	-0.004
	(0.016)	(0.016)	(0.015)	(0.021)	(0.017)
Tuition/fee: In-state[a]	-0.023*	-0.023*	-0.024*	-0.039**	-0.008
	(0.010)	(0.010)	(0.010)	(0.012)	(0.014)
Tuition/fee: Out-of-state[a]	0.026***	0.026***	0.026***	0.032***	0.015**
	(0.005)	(0.005)	(0.005)	(0.007)	(0.005)
Avg Amt Grant from State/local Govt[b]	0.024	0.021	-0.004	0.014	-0.108
	(0.076)	(0.076)	(0.074)	(0.102)	(0.101)
Avg Amt of Federal Grant[b]	-0.233	-0.230	-0.255	-0.362	-0.268
	(0.162)	(0.161)	(0.171)	(0.227)	(0.210)
Avg Amt of Loan[b]	0.255+	0.257+	0.300*	0.297+	0.373*
	(0.133)	(0.132)	(0.142)	(0.164)	(0.176)
75th percentile SAT/ACT Math scores		0.006**	0.006**	0.002	-0.001
		(0.002)	(0.002)	(0.003)	(0.003)
No SAT Score		0.389	0.238	-0.144	0.482
		(0.277)	(0.259)	(0.240)	(0.490)
Acceptance Rate		-0.001	0.004	0.005	0.024
		(0.006)	(0.006)	(0.009)	(0.020)
Personal Income per Capita			0.114*	0.137*	0.072
			(0.048)	(0.068)	(0.051)
Unemployment Rate			-0.183+	-0.262+	0.129
			(0.095)	(0.137)	(0.138)
Poverty Rate			-0.074+	-0.050	-0.069
			(0.038)	(0.051)	(0.046)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			-30.870	-2.712	56.849
			(21.795)	(29.874)	(37.454)
Pct: Hispanic Pop 18-24			47.098**	100.531***	27.408
			(15.695)	(22.844)	(20.220)
AY 2009-2010	0.114	0.122	1.010**	0.852+	0.510
	(0.157)	(0.158)	(0.334)	(0.495)	(0.431)
AY 2010-2011	0.108	0.018	0.781*	0.934+	-0.396
	(0.140)	(0.150)	(0.358)	(0.545)	(0.426)
AY 2011-2012	0.593***	0.601***	1.096**	0.760	0.078
	(0.157)	(0.157)	(0.351)	(0.515)	(0.442)
AY 2012-2013	0.468**	0.480**	0.774*	0.461	-0.426
	(0.170)	(0.169)	(0.351)	(0.511)	(0.491)
AY 2013-2014	0.596**	0.608**	0.767*	0.437	-0.583
	(0.189)	(0.189)	(0.351)	(0.486)	(0.542)
AY 2014-2015	0.826***	0.829***	0.562	0.170	-0.586
	(0.197)	(0.197)	(0.372)	(0.490)	(0.637)
AY 2015-2016	0.984***	0.991***	0.161	-0.414	-0.680
	(0.217)	(0.217)	(0.442)	(0.601)	(0.737)
AY 2016-2017	1.137***	1.149***	0.007	-0.577	-0.761
	(0.252)	(0.254)	(0.482)	(0.668)	(0.806)
AY 2017-2018	1.434***	1.355***	-0.152	-0.663	-0.727
	(0.259)	(0.256)	(0.520)	(0.723)	(0.867)
AY 2018-2019	1.700***	1.610***	-0.345	-0.652	-0.854
	(0.286)	(0.281)	(0.578)	(0.791)	(0.937)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	13.829***	10.178***	3.937	-5.808	-3.665
	(0.797)	(1.468)	(5.452)	(8.238)	(7.682)
Sample Size	5761	5761	5761	3353	2408
R-Squared	0.98	0.98	0.98	0.98	0.98
Fixed Effects vs. Pooled (F-Test)	255.86***	544.59***	3373.47***	5088.87***	2733.06***
Fixed vs. Random Effects (χ^2)	191.61***	267.45***	292.52***	174.55***	173.77***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix B.3: The Relationship between Tuition Discounting and Underrepresented Student Percentage Excluding Computed Observations

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.032	0.030	0.001	0.035	-0.048
	(0.030)	(0.030)	(0.027)	(0.037)	(0.037)
Tuition/fee: In-state[a]	0.028+	0.029+	0.028+	0.038*	0.015
	(0.016)	(0.016)	(0.015)	(0.019)	(0.028)
Tuition/fee: Out-of-state[a]	-0.008	-0.008	-0.006	-0.015	0.001
	(0.008)	(0.008)	(0.007)	(0.010)	(0.011)
Avg Amt Grant from State/local Govt[b]	0.210+	0.233+	0.195+	0.309+	0.090
	(0.127)	(0.125)	(0.114)	(0.169)	(0.128)
Avg Amt of Federal Grant[b]	0.774*	0.752*	0.577+	0.483	0.843*
	(0.333)	(0.327)	(0.300)	(0.388)	(0.362)
Avg Amt of Loan[b]	-0.653*	-0.641*	-0.463+	-0.361	-0.715*
	(0.294)	(0.289)	(0.262)	(0.329)	(0.335)
75th percentile SAT/ACT Math scores		-0.009+	-0.009+	-0.012+	-0.001
		(0.005)	(0.005)	(0.007)	(0.007)
No SAT Score		1.344*	0.888	-0.660	2.444**
		(0.554)	(0.542)	(0.733)	(0.935)
Acceptance Rate		-0.028*	-0.012	-0.043**	-0.012
		(0.012)	(0.011)	(0.017)	(0.044)
Personal Income per Capita			0.093	0.169	-0.008
			(0.095)	(0.115)	(0.157)
Unemployment Rate			-0.509*	-0.495+	-0.564*
			(0.198)	(0.268)	(0.277)
Poverty Rate			0.244**	0.371***	0.064
			(0.075)	(0.107)	(0.106)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			49.009	123.632*	-41.287
			(40.946)	(53.562)	(57.700)
Pct: Hispanic Pop 18-24			205.639***	216.533***	161.008***
			(20.189)	(28.367)	(28.603)
AY 2009-2010	4.655***	4.624***	5.867***	6.535***	4.528**
	(0.874)	(0.869)	(1.210)	(1.671)	(1.614)
AY 2010-2011	1.969***	1.720***	1.790**	1.526	3.077**
	(0.380)	(0.389)	(0.689)	(0.980)	(1.040)
AY 2011-2012	3.568***	3.536***	2.788***	1.132	5.467***
	(0.373)	(0.376)	(0.657)	(0.871)	(1.017)
AY 2012-2013	4.494***	4.497***	2.856***	1.191	5.548***
	(0.370)	(0.372)	(0.675)	(0.846)	(0.993)
AY 2013-2014	4.891***	4.933***	2.743***	1.333	5.012***
	(0.376)	(0.376)	(0.687)	(0.909)	(0.987)
AY 2014-2015	5.324***	5.344***	1.876*	0.352	4.625***
	(0.401)	(0.397)	(0.789)	(1.029)	(1.111)
AY 2015-2016	6.219***	6.209***	1.901*	0.675	4.273***
	(0.418)	(0.413)	(0.872)	(1.138)	(1.239)
AY 2016-2017	6.968***	6.999***	2.005*	0.752	4.692***
	(0.466)	(0.460)	(0.917)	(1.153)	(1.336)
AY 2017-2018	7.546***	7.712***	1.936*	0.948	4.401**
	(0.467)	(0.474)	(0.971)	(1.247)	(1.377)
AY 2018-2019	8.072***	8.282***	1.657	0.869	4.156**
	(0.490)	(0.496)	(1.041)	(1.362)	(1.470)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	30.731***	37.602***	-7.294	-24.981+	13.976
	(1.441)	(3.287)	(9.852)	(13.505)	(13.715)
Sample Size	5761	5761	5761	3353	2408
R-Squared	0.96	0.95	0.96	0.94	0.97
Fixed Effects vs. Pooled (F-Test)	2658.59***	853.65***	1977.56***	781.35***	433.87***
Fixed vs. Random Effects (χ^2)	195.03***	474.35***	497.61***	513.38***	183.35***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix B.4: The Relationship between Tuition Discounting and Low-income Student Percentage Excluding Computed Observations

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Tuition Discount Rate	0.093***	0.094***	0.076**	0.133***	-0.003
	(0.026)	(0.026)	(0.025)	(0.031)	(0.037)
Tuition/fee: In-state[a]	0.018	0.016	0.011	0.029+	-0.008
	(0.013)	(0.013)	(0.013)	(0.016)	(0.025)
Tuition/fee: Out-of-state[a]	-0.009	-0.007	-0.007	-0.021*	0.008
	(0.007)	(0.007)	(0.007)	(0.009)	(0.010)
Avg Amt Grant from State/local Govt[b]	-0.153	-0.126	-0.142	-0.126	-0.299+
	(0.124)	(0.125)	(0.125)	(0.158)	(0.179)
Avg Amt of Federal Grant[b]	0.190	0.169	0.230	0.343	-0.180
	(0.205)	(0.201)	(0.201)	(0.242)	(0.389)
Avg Amt of Loan[b]	-0.230	-0.213	-0.264	-0.410+	0.129
	(0.167)	(0.163)	(0.167)	(0.213)	(0.317)
75th percentile SAT/ACT Math scores		-0.015**	-0.015**	-0.022***	0.007
		(0.005)	(0.005)	(0.006)	(0.007)
No SAT Score		1.150**	1.114**	0.969*	0.673
		(0.375)	(0.360)	(0.475)	(0.615)
Acceptance Rate		0.026**	0.027**	0.033*	0.128***
		(0.010)	(0.010)	(0.015)	(0.036)
Personal Income per Capita			0.084	0.100	-0.097
			(0.088)	(0.107)	(0.138)
Unemployment Rate			-0.166	0.069	-0.430*
			(0.134)	(0.179)	(0.210)
Poverty Rate			0.163**	0.064	0.211*
			(0.055)	(0.067)	(0.085)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Pct: Black Pop 18-24			-110.125***	-76.424+	-6.760
			(32.963)	(39.042)	(59.176)
Pct: Hispanic Pop 18-24			6.166	-20.121	39.112
			(18.811)	(23.162)	(28.502)
AY 2009-2010	0.152	0.180	0.922+	0.641	0.781
	(0.323)	(0.321)	(0.478)	(0.646)	(0.863)
AY 2010-2011	6.082***	6.017***	6.765***	5.884***	7.867***
	(0.348)	(0.355)	(0.540)	(0.763)	(0.884)
AY 2011-2012	11.095***	11.143***	12.007***	10.719***	13.444***
	(0.370)	(0.370)	(0.568)	(0.722)	(0.986)
AY 2012-2013	11.758***	11.788***	12.713***	11.459***	13.769***
	(0.390)	(0.389)	(0.584)	(0.699)	(1.082)
AY 2013-2014	10.364***	10.370***	11.519***	10.845***	11.480***
	(0.404)	(0.403)	(0.586)	(0.703)	(1.102)
AY 2014-2015	10.536***	10.489***	11.278***	11.031***	10.990***
	(0.419)	(0.417)	(0.636)	(0.731)	(1.152)
AY 2015-2016	10.493***	10.428***	11.110***	11.259***	10.550***
	(0.427)	(0.422)	(0.700)	(0.807)	(1.221)
AY 2016-2017	9.328***	9.238***	9.892***	10.508***	8.800***
	(0.445)	(0.439)	(0.724)	(0.868)	(1.235)
AY 2017-2018	8.734***	8.821***	9.251***	10.267***	7.669***
	(0.441)	(0.444)	(0.780)	(0.933)	(1.281)
AY 2018-2019	10.299***	10.384***	10.613***	12.317***	8.584***
	(0.466)	(0.476)	(0.862)	(1.045)	(1.381)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Constant	32.844***	39.111***	49.613***	53.574***	18.621
	(1.334)	(2.962)	(8.364)	(10.337)	(12.416)
Sample Size	5761	5761	5761	3353	2408
R-Squared	0.94	0.94	0.94	0.96	0.93
Fixed Effects vs. Pooled (F-Test)	799.73***	312.15***	525.80***	309.12***	231.68***
Fixed vs. Random Effects (χ^2)	427.64***	780.24***	1132.21***	859.32***	500.33***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix B.5: The Relationship between Tuition Discounting and Non-resident Student Percentage Excluding Computed Observations

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.044	0.044	0.029	-0.019	0.077
	(0.031)	(0.031)	(0.031)	(0.039)	(0.048)
Tuition/fee: In-state[a]	-0.017	-0.015	-0.010	-0.013	0.025
	(0.014)	(0.014)	(0.014)	(0.014)	(0.030)
Tuition/fee: Out-of-state[a]	0.019*	0.018*	0.018*	0.020*	0.011
	(0.009)	(0.009)	(0.009)	(0.008)	(0.017)
Avg Amt Grant from State/local Govt[b]	0.159	0.154	0.142	0.121	0.102
	(0.117)	(0.114)	(0.113)	(0.157)	(0.156)
Avg Amt of Federal Grant[b]	-0.769**	-0.769**	-0.817**	-0.403	-1.298*
	(0.271)	(0.273)	(0.273)	(0.348)	(0.561)
Avg Amt of Loan[b]	0.647**	0.637**	0.741***	0.493*	1.046*
	(0.214)	(0.212)	(0.208)	(0.222)	(0.501)
75th percentile SAT/ACT Math scores		0.001	0.001	0.001	-0.005
		(0.005)	(0.005)	(0.005)	(0.013)
No SAT Score		-0.588	-0.773+	-0.218	-2.365*
		(0.405)	(0.407)	(0.361)	(0.985)
Acceptance Rate		-0.050***	-0.044**	-0.073***	-0.030
		(0.015)	(0.015)	(0.020)	(0.043)
Personal Income per Capita			0.221*	0.287*	0.246
			(0.106)	(0.130)	(0.177)
Unemployment Rate			-0.347*	-0.419*	-0.231
			(0.163)	(0.207)	(0.314)
Poverty Rate			-0.096	-0.143+	-0.104
			(0.067)	(0.085)	(0.103)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct: Black Pop 18-24			71.947+	65.742	34.365
			(43.122)	(58.370)	(58.066)
Pct: Hispanic Pop 18-24			54.667**	76.863**	12.013
			(20.789)	(27.940)	(32.231)
AY 2009-2010	0.014	-0.051	1.406+	1.490	1.568
	(0.360)	(0.361)	(0.722)	(0.908)	(1.463)
AY 2010-2011	-0.494	-0.521	0.632	0.860	0.109
	(0.358)	(0.360)	(0.757)	(1.099)	(1.266)
AY 2011-2012	-0.552	-0.639+	-0.386	-0.485	0.291
	(0.368)	(0.369)	(0.684)	(0.947)	(1.206)
AY 2012-2013	-0.181	-0.226	-0.644	-0.796	0.273
	(0.381)	(0.382)	(0.652)	(0.931)	(1.132)
AY 2013-2014	-0.394	-0.381	-1.175+	-1.260	-0.470
	(0.430)	(0.431)	(0.627)	(0.830)	(1.104)
AY 2014-2015	-0.128	-0.065	-1.648**	-2.223**	-0.350
	(0.440)	(0.440)	(0.635)	(0.810)	(1.128)
AY 2015-2016	-0.057	-0.005	-2.509***	-3.258***	-1.166
	(0.467)	(0.465)	(0.758)	(0.957)	(1.379)
AY 2016-2017	0.199	0.306	-2.571**	-3.582***	-0.933
	(0.492)	(0.491)	(0.815)	(1.011)	(1.507)
AY 2017-2018	0.566	0.704	-2.606**	-3.674***	-0.939
	(0.505)	(0.488)	(0.879)	(1.070)	(1.578)
AY 2018-2019	0.206	0.395	-3.492***	-4.402***	-2.093
	(0.511)	(0.497)	(0.985)	(1.206)	(1.741)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Constant	10.818***	14.141***	-13.013	-19.355	1.463
	(1.516)	(3.318)	(10.330)	(13.910)	(15.207)
Sample Size	5761	5761	5761	3353	2408
R-Squared	0.92	0.92	0.92	0.94	0.94
Fixed Effects vs. Pooled (F-Test)	397.93***	508.12***	2225.18***	1762.46***	192.83***
Fixed vs. Random Effects (χ^2)	123.07***	122.84***	135.45***	136.67***	67.11***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix C.1: The Relationship between Tuition Discounting and Full-time Undergraduate Enrollment Including Institutional Finance-related Variables

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.173*	0.165**	0.100+	0.116	0.024
	(0.069)	(0.063)	(0.056)	(0.077)	(0.056)
Tuition/fee: In-state[a]	-0.073+	-0.071*	-0.082*	-0.151***	0.003
	(0.038)	(0.035)	(0.035)	(0.045)	(0.058)
Tuition/fee: Out-of-state[a]	0.105***	0.097***	0.099***	0.129***	0.040*
	(0.021)	(0.020)	(0.020)	(0.029)	(0.020)
Avg Amt Grant from State/local Govt[b]	-0.170	-0.185	-0.336	-0.585+	-0.490
	(0.269)	(0.263)	(0.258)	(0.344)	(0.411)
Avg Amt of Federal Grant[b]	-0.403	-0.396	-0.457	-0.653	-0.146
	(0.712)	(0.696)	(0.728)	(0.934)	(0.925)
Avg Amt of Loan[b]	0.656	0.484	0.595	0.509	0.584
	(0.596)	(0.580)	(0.624)	(0.761)	(0.804)
75th percentile SAT/ACT Math scores		0.019+	0.019+	0.016	-0.028
		(0.010)	(0.010)	(0.011)	(0.021)
No SAT Score		2.492	1.530	-0.979	3.925*
		(1.520)	(1.403)	(1.613)	(1.611)
Acceptance Rate		-0.036	-0.017	-0.022	0.074
		(0.024)	(0.022)	(0.041)	(0.084)
Pct Revenue: Tuition/fees		0.075	0.156*	0.240**	0.070
		(0.063)	(0.061)	(0.083)	(0.088)
Pct Revenue: State Appropriations		-0.176*	-0.241**	-0.196+	-0.146+
		(0.070)	(0.076)	(0.109)	(0.084)
Pct Revenue: Local Appropriations		-0.123	-0.219	-0.963	0.033
		(0.185)	(0.195)	(0.705)	(0.087)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct Revenue: Govt Grants		0.057	0.026	-0.051	0.164**
		(0.062)	(0.061)	(0.091)	(0.063)
Pct Expense: Instruction		-0.179**	-0.144*	-0.159+	-0.042
		(0.060)	(0.057)	(0.088)	(0.060)
Pct Expense: Research		-0.257*	-0.200*	-0.126	-0.197
		(0.104)	(0.100)	(0.126)	(0.260)
Pct Expense: Academic Support		0.301	0.175	-0.039	0.273
		(0.191)	(0.191)	(0.274)	(0.304)
Pct Expense: Student Services		-0.639***	-0.470**	-0.646**	-0.223
		(0.160)	(0.156)	(0.237)	(0.182)
Personal Income per Capita			0.576**	0.685**	0.319+
			(0.193)	(0.262)	(0.186)
Unemployment Rate			-0.789*	-1.241**	0.419
			(0.353)	(0.478)	(0.491)
Poverty Rate			-0.294*	-0.127	-0.234
			(0.139)	(0.185)	(0.142)
Pct: Black Pop 18-24			-188.131*	-118.314	181.579
			(83.690)	(113.665)	(153.918)
Pct: Hispanic Pop 18-24			186.071**	430.159***	-0.740
			(68.836)	(87.074)	(111.463)
AY 2009-2010	2.610***	3.912***	6.985***	8.755***	2.534
	(0.351)	(0.713)	(1.385)	(1.998)	(1.583)
AY 2010-2011	4.025***	5.305***	8.232***	9.787***	3.452+
	(0.471)	(0.769)	(1.506)	(2.186)	(1.862)
AY 2011-2012	5.602***	6.508***	8.114***	8.232***	3.618+
	(0.547)	(0.896)	(1.513)	(2.162)	(2.003)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
AY 2012-2013	5.520***	6.555***	7.300***	7.143**	2.515
	(0.594)	(0.962)	(1.563)	(2.207)	(2.300)
AY 2013-2014	4.988***	6.336***	6.688***	6.688**	1.202
	(0.690)	(0.980)	(1.595)	(2.275)	(2.354)
AY 2014-2015	5.293***	6.721***	5.124**	4.462+	0.929
	(0.757)	(1.073)	(1.744)	(2.363)	(2.905)
AY 2015-2016	5.463***	6.795***	2.694	1.358	0.432
	(0.849)	(1.123)	(2.005)	(2.738)	(3.306)
AY 2016-2017	5.874***	7.274***	1.887	-0.027	0.538
	(0.944)	(1.172)	(2.161)	(2.909)	(3.719)
AY 2017-2018	6.690***	7.691***	0.791	-1.033	0.771
	(1.011)	(1.129)	(2.287)	(2.930)	(4.130)
AY 2018-2019	6.685***	7.770***	-1.134	-3.149	0.165
	(1.115)	(1.205)	(2.560)	(3.213)	(4.487)
Constant	64.405***	70.982***	50.560*	12.352	24.388
	(3.253)	(7.322)	(20.830)	(32.130)	(31.197)
Sample Size	5914	5914	5914	3444	2470
R-Squared	0.99	0.99	0.99	0.99	0.99
Fixed Effects vs. Pooled (F-Test)	232.86***	2672.19***	1855.19***	1471.24***	2313.28***
Fixed vs. Random Effects (χ^2)	243.80***	349.20***	357.84***	219.76***	279.80***

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01, *** p<.001
[a] In hundreds, adjusted to 2018 dollars
[b] In thousands, adjusted to 2018 dollars

Appendix C.2: The Relationship between Tuition Discounting and Full-time Freshmen Enrollment Including Institutional Finance-related Variables

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.027+	0.031*	0.015	0.016	0.005
	(0.016)	(0.015)	(0.014)	(0.019)	(0.016)
Tuition/fee: In-state[a]	-0.022*	-0.022*	-0.024**	-0.035**	-0.014
	(0.010)	(0.009)	(0.009)	(0.011)	(0.014)
Tuition/fee: Out-of-state[a]	0.026***	0.024***	0.024***	0.029***	0.014**
	(0.005)	(0.005)	(0.005)	(0.007)	(0.004)
Avg Amt Grant from State/local Govt[b]	0.028	0.019	-0.018	-0.025	-0.087
	(0.077)	(0.074)	(0.072)	(0.100)	(0.101)
Avg Amt of Federal Grant[b]	-0.251	-0.246	-0.259	-0.334	-0.269
	(0.166)	(0.162)	(0.171)	(0.228)	(0.205)
Avg Amt of Loan[b]	0.296*	0.242+	0.270+	0.265	0.357*
	(0.138)	(0.134)	(0.143)	(0.171)	(0.172)
75th percentile SAT/ACT Math scores		0.004	0.004	0.000	-0.002
		(0.003)	(0.003)	(0.003)	(0.003)
No SAT Score		0.502	0.289	0.145	0.724
		(0.432)	(0.406)	(0.455)	(0.512)
Acceptance Rate		0.000	0.004	0.009	0.019
		(0.006)	(0.005)	(0.009)	(0.020)
Pct Revenue: Tuition/fees		0.033*	0.053***	0.096***	0.030+
		(0.015)	(0.015)	(0.022)	(0.016)
Pct Revenue: State Appropriations		-0.076***	-0.093***	-0.086**	-0.063***
		(0.018)	(0.020)	(0.030)	(0.015)
Pct Revenue: Local Appropriations		0.013	-0.009	-0.164	0.054*
		(0.050)	(0.052)	(0.121)	(0.024)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct Revenue: Govt Grants		0.002	-0.006	-0.048*	0.039*
		(0.016)	(0.016)	(0.023)	(0.017)
Pct Expense: Instruction		-0.033*	-0.025+	-0.029	0.005
		(0.014)	(0.014)	(0.022)	(0.012)
Pct Expense: Research		-0.064*	-0.051+	-0.026	-0.059
		(0.028)	(0.027)	(0.031)	(0.059)
Pct Expense: Academic Support		0.075	0.045	0.024	0.022
		(0.046)	(0.046)	(0.066)	(0.067)
Pct Expense: Student Services		-0.113**	-0.072+	-0.097	-0.017
		(0.041)	(0.040)	(0.063)	(0.045)
Personal Income per Capita			0.171***	0.200**	0.121*
			(0.048)	(0.067)	(0.048)
Unemployment Rate			-0.184*	-0.242+	0.104
			(0.092)	(0.129)	(0.133)
Poverty Rate			-0.076*	-0.054	-0.062
			(0.037)	(0.047)	(0.045)
Pct: Black Pop 18-24			-36.865+	-26.153	53.747
			(22.295)	(29.545)	(38.440)
Pct: Hispanic Pop 18-24			42.167**	95.030***	22.047
			(15.539)	(21.748)	(21.778)
AY 2009-2010	0.123	0.165	0.940**	0.968+	0.179
	(0.115)	(0.194)	(0.351)	(0.553)	(0.409)
AY 2010-2011	0.112	0.152	0.875*	1.014+	-0.421
	(0.140)	(0.203)	(0.378)	(0.595)	(0.435)
AY 2011-2012	0.584***	0.425+	0.748*	0.439	-0.338
	(0.157)	(0.227)	(0.373)	(0.566)	(0.463)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
AY 2012-2013	0.457**	0.284	0.369	0.080	-0.844
	(0.170)	(0.237)	(0.379)	(0.578)	(0.525)
AY 2013-2014	0.583**	0.466+	0.466	0.179	-0.919
	(0.189)	(0.246)	(0.387)	(0.564)	(0.585)
AY 2014-2015	0.809***	0.700**	0.198	-0.171	-1.000
	(0.197)	(0.259)	(0.421)	(0.569)	(0.693)
AY 2015-2016	0.968***	0.843**	-0.312	-0.965	-1.074
	(0.217)	(0.256)	(0.480)	(0.649)	(0.787)
AY 2016-2017	1.110***	0.985***	-0.470	-1.192+	-1.101
	(0.252)	(0.270)	(0.516)	(0.698)	(0.872)
AY 2017-2018	1.418***	1.249***	-0.574	-1.127	-1.090
	(0.259)	(0.262)	(0.549)	(0.728)	(0.934)
AY 2018-2019	1.680***	1.524***	-0.801	-1.179	-1.230
	(0.286)	(0.287)	(0.613)	(0.809)	(1.009)
Constant	13.606***	15.331***	8.057	0.664	-3.269
	(0.790)	(1.836)	(5.347)	(7.970)	(7.552)
Sample Size	5914	5914	5914	3444	2470
R-Squared	0.94	0.95	0.95	0.98	0.98
Fixed Effects vs. Pooled (F-Test)	1342.28***	439.85***	982.59***	2345.20***	7414.64***
Fixed vs. Random Effects (χ^2)	197.47***	606.12***	569.76***	196.79***	212.20***

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01, *** p<.001
[a] In hundreds, adjusted to 2018 dollars
[b] In thousands, adjusted to 2018 dollars

Appendix C.3: The Relationship between Tuition Discounting and Underrepresented Student Percentage Including Institutional Finance-related Variables

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.032	0.023	-0.002	0.020	-0.031
	(0.029)	(0.028)	(0.026)	(0.037)	(0.036)
Tuition/fee: In-state[a]	0.028+	0.026+	0.024+	0.036+	0.012
	(0.016)	(0.015)	(0.014)	(0.018)	(0.029)
Tuition/fee: Out-of-state[a]	-0.008	-0.009	-0.007	-0.015	-0.002
	(0.008)	(0.008)	(0.007)	(0.009)	(0.011)
Avg Amt Grant from State/local Govt[b]	0.202	0.224+	0.171	0.277	0.113
	(0.125)	(0.124)	(0.113)	(0.169)	(0.125)
Avg Amt of Federal Grant[b]	0.701*	0.739*	0.578+	0.461	0.885*
	(0.317)	(0.318)	(0.298)	(0.384)	(0.353)
Avg Amt of Loan[b]	-0.574*	-0.638*	-0.458+	-0.320	-0.796*
	(0.281)	(0.286)	(0.265)	(0.326)	(0.343)
75th percentile SAT/ACT Math scores		-0.011*	-0.012*	-0.016*	0.001
		(0.006)	(0.006)	(0.007)	(0.008)
No SAT Score		3.367***	2.904***	1.733	3.359**
		(0.733)	(0.723)	(1.107)	(1.045)
Acceptance Rate		-0.029*	-0.015	-0.041**	-0.030
		(0.011)	(0.011)	(0.015)	(0.045)
Pct Revenue: Tuition/fees		-0.011	0.001	-0.014	0.014
		(0.028)	(0.027)	(0.040)	(0.041)
Pct Revenue: State Appropriations		-0.064*	-0.078*	-0.050	-0.111*
		(0.032)	(0.032)	(0.044)	(0.046)
Pct Revenue: Local Appropriations		0.136	0.084	0.026	0.054
		(0.100)	(0.094)	(0.376)	(0.106)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct Revenue: Govt Grants		0.085**	0.080**	0.061+	0.116*
		(0.028)	(0.026)	(0.036)	(0.046)
Pct Expense: Instruction		-0.027	0.001	0.004	0.026
		(0.032)	(0.032)	(0.048)	(0.040)
Pct Expense: Research		-0.231***	-0.189**	-0.173**	-0.100
		(0.064)	(0.064)	(0.060)	(0.097)
Pct Expense: Academic Support		-0.094	-0.138*	-0.093	-0.118
		(0.067)	(0.064)	(0.093)	(0.090)
Pct Expense: Student Services		-0.026	0.017	0.083	0.012
		(0.084)	(0.082)	(0.124)	(0.110)
Personal Income per Capita			0.122	0.163	0.097
			(0.093)	(0.115)	(0.171)
Unemployment Rate			-0.486**	-0.467+	-0.513*
			(0.188)	(0.266)	(0.251)
Poverty Rate			0.186*	0.295**	0.089
			(0.074)	(0.105)	(0.112)
Pct: Black Pop 18-24			49.083	126.465*	-82.934
			(40.805)	(53.362)	(59.337)
Pct: Hispanic Pop 18-24			183.058***	187.254***	154.790***
			(19.564)	(28.559)	(27.474)
AY 2009-2010	3.693***	4.046***	4.794***	4.907***	3.736**
	(0.645)	(0.700)	(1.017)	(1.400)	(1.321)
AY 2010-2011	2.002***	2.338***	2.231**	1.577+	2.760**
	(0.377)	(0.450)	(0.678)	(0.936)	(1.006)
AY 2011-2012	3.579***	3.834***	2.919***	1.396+	4.659***
	(0.371)	(0.464)	(0.651)	(0.834)	(1.092)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
AY 2012-2013	4.494***	4.879***	3.091***	1.537+	4.939***
	(0.368)	(0.461)	(0.663)	(0.827)	(1.092)
AY 2013-2014	4.867***	5.374***	3.073***	1.734+	4.631***
	(0.373)	(0.460)	(0.675)	(0.900)	(1.053)
AY 2014-2015	5.288***	5.756***	2.230**	0.790	4.212***
	(0.398)	(0.488)	(0.778)	(1.031)	(1.203)
AY 2015-2016	6.191***	6.621***	2.235**	1.121	3.970**
	(0.412)	(0.489)	(0.852)	(1.148)	(1.299)
AY 2016-2017	6.935***	7.456***	2.444**	1.266	4.548**
	(0.461)	(0.514)	(0.895)	(1.187)	(1.377)
AY 2017-2018	7.514***	8.145***	2.442**	1.646	4.145**
	(0.461)	(0.500)	(0.939)	(1.255)	(1.408)
AY 2018-2019	8.025***	8.696***	2.171*	1.671	3.839**
	(0.481)	(0.506)	(1.002)	(1.366)	(1.478)
Constant	30.621***	43.170***	0.715	-14.768	16.395
	(1.439)	(3.677)	(9.600)	(12.868)	(14.179)
Sample Size	5914	5914	5914	3444	2470
R-Squared	0.94	0.95	0.95	0.94	0.96
Fixed Effects vs. Pooled (F-Test)	1342.28***	439.85***	982.59***	736.00***	306.79***
Fixed vs. Random Effects (χ^2)	197.47***	606.12***	569.76***	528.67***	256.94***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix C.4: The Relationship between Tuition Discounting and Low-income Student Percentage Including Institutional Finance-related Variables

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.095***	0.060*	0.052*	0.087**	-0.006
	(0.026)	(0.023)	(0.023)	(0.030)	(0.033)
Tuition/fee: In-state[a]	0.017	0.009	0.007	0.019	-0.002
	(0.013)	(0.013)	(0.013)	(0.015)	(0.024)
Tuition/fee: Out-of-state[a]	-0.010	-0.004	-0.004	-0.015+	0.007
	(0.007)	(0.007)	(0.007)	(0.009)	(0.010)
Avg Amt Grant from State/local Govt[b]	-0.156	-0.103	-0.109	-0.081	-0.281
	(0.124)	(0.121)	(0.120)	(0.153)	(0.176)
Avg Amt of Federal Grant[b]	0.237	0.261	0.300	0.372	0.001
	(0.206)	(0.193)	(0.196)	(0.242)	(0.370)
Avg Amt of Loan[b]	-0.270	-0.249	-0.277+	-0.360+	-0.044
	(0.169)	(0.160)	(0.163)	(0.208)	(0.310)
75th percentile SAT/ACT Math scores		-0.015**	-0.014**	-0.022**	0.009
		(0.005)	(0.005)	(0.007)	(0.007)
No SAT Score		2.613***	2.471***	2.557**	1.284+
		(0.544)	(0.539)	(0.799)	(0.724)
Acceptance Rate		0.017+	0.019*	0.023	0.122**
		(0.010)	(0.009)	(0.015)	(0.037)
Pct Revenue: Tuition/fees		-0.146***	-0.137***	-0.175***	-0.089+
		(0.026)	(0.027)	(0.031)	(0.048)
Pct Revenue: State Appropriations		-0.040+	-0.045*	-0.033	-0.045
		(0.023)	(0.022)	(0.026)	(0.038)
Pct Revenue: Local Appropriations		-0.208+	-0.204+	-0.856	-0.142*
		(0.111)	(0.109)	(0.851)	(0.057)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct Revenue: Govt Grants		0.215***	0.209***	0.228***	0.137**
		(0.030)	(0.030)	(0.038)	(0.046)
Pct Expense: Instruction		-0.016	-0.012	0.015	-0.079*
		(0.025)	(0.025)	(0.035)	(0.033)
Pct Expense: Research		-0.144**	-0.136**	-0.150**	-0.039
		(0.050)	(0.052)	(0.057)	(0.096)
Pct Expense: Academic Support		-0.034	-0.043	-0.074	0.129
		(0.059)	(0.059)	(0.056)	(0.104)
Pct Expense: Student Services		-0.106	-0.084	-0.063	0.036
		(0.072)	(0.070)	(0.098)	(0.099)
Personal Income per Capita			-0.005	0.014	-0.181
			(0.082)	(0.098)	(0.133)
Unemployment Rate			-0.240+	0.010	-0.521*
			(0.126)	(0.168)	(0.210)
Poverty Rate			0.123*	0.003	0.221**
			(0.052)	(0.062)	(0.083)
Pct: Black Pop 18-24			-61.392+	-20.030	5.920
			(32.792)	(37.545)	(62.476)
Pct: Hispanic Pop 18-24			7.942	-21.238	39.260
			(18.746)	(21.944)	(30.002)
AY 2009-2010	-0.002	0.043	0.696	0.408	0.246
	(0.274)	(0.410)	(0.516)	(0.614)	(0.952)
AY 2010-2011	6.066***	6.166***	6.869***	6.042***	7.612***
	(0.348)	(0.456)	(0.580)	(0.685)	(0.973)
AY 2011-2012	11.098***	11.601***	12.323***	11.251***	13.431***
	(0.371)	(0.491)	(0.612)	(0.683)	(1.072)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
AY 2012-2013	11.775***	12.589***	13.226***	12.150***	14.026***
	(0.390)	(0.516)	(0.639)	(0.664)	(1.170)
AY 2013-2014	10.379***	11.367***	12.022***	11.470***	11.735***
	(0.405)	(0.546)	(0.661)	(0.662)	(1.180)
AY 2014-2015	10.539***	11.552***	11.885***	11.837***	11.288***
	(0.421)	(0.564)	(0.716)	(0.696)	(1.268)
AY 2015-2016	10.514***	11.638***	11.907***	12.301***	11.040***
	(0.428)	(0.557)	(0.761)	(0.779)	(1.304)
AY 2016-2017	9.333***	10.573***	10.786***	11.612***	9.347***
	(0.447)	(0.562)	(0.780)	(0.839)	(1.324)
AY 2017-2018	8.759***	9.996***	10.061***	11.297***	8.071***
	(0.442)	(0.541)	(0.812)	(0.888)	(1.348)
AY 2018-2019	10.327***	11.540***	11.495***	13.439***	9.050***
	(0.467)	(0.583)	(0.896)	(1.012)	(1.439)
Constant	32.926***	42.893***	50.561***	52.787***	22.920+
	(1.319)	(3.878)	(8.527)	(9.987)	(12.773)
Sample Size	5914	5914	5914	3444	2470
R-Squared	0.94	0.94	0.94	0.96	0.93
Fixed Effects vs. Pooled (F-Test)	661.75***	337.79***	620.18***	152.12***	308.31***
Fixed vs. Random Effects (χ^2)	445.07***	1172.62***	1255.69***	832.12***	557.39***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix C.5: The Relationship between Tuition Discounting and Non-resident Student Percentage Including Institutional Finance-related Variables

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Tuition Discount Rate	0.038	0.056+	0.041	0.008	0.076
	(0.030)	(0.030)	(0.029)	(0.036)	(0.047)
Tuition/fee: In-state[a]	-0.016	-0.012	-0.010	-0.006	0.014
	(0.014)	(0.014)	(0.014)	(0.013)	(0.031)
Tuition/fee: Out-of-state[a]	0.019*	0.015+	0.015+	0.015+	0.012
	(0.008)	(0.008)	(0.008)	(0.008)	(0.016)
Avg Amt Grant from State/local Govt[b]	0.150	0.129	0.100	0.053	0.110
	(0.117)	(0.109)	(0.108)	(0.147)	(0.150)
Avg Amt of Federal Grant[b]	-0.734**	-0.733**	-0.768**	-0.339	-1.202*
	(0.276)	(0.273)	(0.272)	(0.334)	(0.553)
Avg Amt of Loan[b]	0.622**	0.550*	0.630**	0.374+	0.905+
	(0.223)	(0.218)	(0.215)	(0.223)	(0.492)
75th percentile SAT/ACT Math scores		0.002	0.002	-0.000	-0.005
		(0.006)	(0.006)	(0.006)	(0.013)
No SAT Score		-1.039+	-1.150*	0.037	-2.416*
		(0.565)	(0.551)	(0.530)	(1.141)
Acceptance Rate		-0.044**	-0.039**	-0.062**	-0.036
		(0.015)	(0.015)	(0.020)	(0.044)
Pct Revenue: Tuition/fees		0.089***	0.109***	0.150***	0.071*
		(0.026)	(0.025)	(0.033)	(0.036)
Pct Revenue: State Appropriations		-0.039	-0.061*	-0.085**	-0.036
		(0.024)	(0.025)	(0.032)	(0.039)
Pct Revenue: Local Appropriations		-0.067	-0.089+	0.064	-0.083
		(0.053)	(0.053)	(0.255)	(0.051)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
Pct Revenue: Govt Grants		-0.100***	-0.103***	-0.130***	-0.046
		(0.023)	(0.022)	(0.029)	(0.037)
Pct Expense: Instruction		-0.091**	-0.079*	-0.071*	-0.107*
		(0.030)	(0.031)	(0.033)	(0.045)
Pct Expense: Research		-0.018	-0.004	0.023	-0.174+
		(0.052)	(0.047)	(0.042)	(0.099)
Pct Expense: Academic Support		0.108+	0.074	0.073	0.117
		(0.060)	(0.057)	(0.072)	(0.098)
Pct Expense: Student Services		0.034	0.070	-0.021	0.059
		(0.097)	(0.099)	(0.104)	(0.157)
Personal Income per Capita			0.266**	0.314*	0.250+
			(0.102)	(0.127)	(0.149)
Unemployment Rate			-0.320*	-0.411*	-0.270
			(0.152)	(0.196)	(0.266)
Poverty Rate			-0.115+	-0.167*	-0.132
			(0.063)	(0.077)	(0.101)
Pct: Black Pop 18-24			38.751	18.991	15.420
			(41.659)	(56.527)	(56.901)
Pct: Hispanic Pop 18-24			50.445*	70.800**	4.357
			(19.610)	(25.313)	(31.117)
AY 2009-2010	0.129	0.500	1.765*	1.930*	2.374+
	(0.321)	(0.497)	(0.721)	(0.961)	(1.393)
AY 2010-2011	-0.525	-0.207	0.863	1.102	1.015
	(0.359)	(0.508)	(0.758)	(1.069)	(1.320)
AY 2011-2012	-0.571	-0.604	-0.439	-0.730	0.967
	(0.369)	(0.544)	(0.745)	(1.031)	(1.315)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**More selective**	**Less selective**
AY 2012-2013	-0.204	-0.358	-0.798	-1.134	0.894
	(0.380)	(0.568)	(0.738)	(1.050)	(1.287)
AY 2013-2014	-0.397	-0.558	-1.275+	-1.537	0.176
	(0.427)	(0.581)	(0.706)	(0.960)	(1.258)
AY 2014-2015	-0.139	-0.266	-1.789*	-2.586**	0.231
	(0.438)	(0.586)	(0.740)	(0.997)	(1.246)
AY 2015-2016	-0.052	-0.306	-2.818**	-3.865***	-0.651
	(0.463)	(0.591)	(0.860)	(1.151)	(1.411)
AY 2016-2017	0.215	-0.098	-2.984**	-4.329***	-0.478
	(0.487)	(0.596)	(0.911)	(1.206)	(1.522)
AY 2017-2018	0.583	0.291	-3.040**	-4.262***	-0.585
	(0.500)	(0.568)	(0.955)	(1.199)	(1.572)
AY 2018-2019	0.230	-0.010	-3.986***	-5.093***	-1.744
	(0.504)	(0.571)	(1.057)	(1.329)	(1.713)
Constant	10.891***	16.981***	-6.412	-7.025	10.286
	(1.478)	(4.038)	(9.810)	(13.806)	(13.904)
Sample Size	5914	5914	5914	3444	2470
R-Squared	0.92	0.92	0.92	0.93	0.93
Fixed Effects vs. Pooled (F-Test)	394.79***	1200.13***	1831.47***	724.87***	314.50***
Fixed vs. Random Effects (χ^2)	124.93***	141.04***	148.27***	167.00***	85.61***

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01, *** p<.001
[a] In hundreds, adjusted to 2018 dollars
[b] In thousands, adjusted to 2018 dollars

Appendix D.1: The Relationship between Tuition Discounting and Full-time Undergraduate Enrollment with Different Institutional Selectivity Levels

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Tuition Discount Rate	0.093	0.053	0.073	0.045
	(0.092)	(0.054)	(0.084)	(0.058)
Tuition/fee: In-state[a]	-0.203***	-0.036	-0.146**	-0.056
	(0.059)	(0.040)	(0.051)	(0.045)
Tuition/fee: Out-of-state[a]	0.175***	0.057**	0.150***	0.057**
	(0.038)	(0.017)	(0.033)	(0.019)
Avg Amt Grant from State/local Govt[b]	-0.287	-0.455	-0.572+	-0.345
	(0.365)	(0.317)	(0.341)	(0.350)
Avg Amt of Federal Grant[b]	-0.688	-0.994	-0.673	-0.910
	(1.086)	(0.819)	(1.048)	(0.888)
Avg Amt of Loan[b]	0.399	1.514*	0.517	1.443+
	(0.888)	(0.724)	(0.864)	(0.791)
75th percentile SAT/ACT Math scores	0.029*	-0.024	0.023*	-0.023
	(0.012)	(0.014)	(0.011)	(0.017)
No SAT Score	-2.287	4.801**	-2.155	4.292**
	(1.805)	(1.668)	(1.612)	(1.520)
Acceptance Rate	-0.049	-0.019	-0.031	0.006
	(0.050)	(0.044)	(0.044)	(0.050)
Personal Income per Capita	0.694*	0.122	0.700*	0.192
	(0.313)	(0.199)	(0.294)	(0.204)
Unemployment Rate	-2.207***	0.426	-1.635**	0.584
	(0.610)	(0.397)	(0.552)	(0.432)
Poverty Rate	0.046	-0.416**	0.115	-0.405**
	(0.226)	(0.150)	(0.211)	(0.143)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Pct: Black Pop 18-24	-12.630	65.013	-72.172	159.611
	(132.559)	(111.223)	(131.987)	(124.101)
Pct: Hispanic Pop 18-24	436.282***	91.546	444.293***	56.316
	(102.622)	(89.945)	(96.742)	(97.473)
AY 2009-2010	10.223***	1.717	7.506***	2.087+
	(2.048)	(1.136)	(1.918)	(1.212)
AY 2010-2011	11.413***	3.199*	8.365***	3.535*
	(2.409)	(1.326)	(2.189)	(1.452)
AY 2011-2012	10.349***	4.294***	7.277**	4.466**
	(2.408)	(1.251)	(2.202)	(1.357)
AY 2012-2013	8.231***	3.748**	5.745*	3.934*
	(2.407)	(1.429)	(2.241)	(1.575)
AY 2013-2014	6.823**	2.013	4.980*	2.296
	(2.472)	(1.519)	(2.333)	(1.673)
AY 2014-2015	3.287	2.033	2.011	2.219
	(2.547)	(1.829)	(2.398)	(2.040)
AY 2015-2016	0.103	1.375	-0.576	1.554
	(3.086)	(2.119)	(2.865)	(2.404)
AY 2016-2017	-1.300	0.812	-1.733	0.853
	(3.423)	(2.358)	(3.135)	(2.678)
AY 2017-2018	-2.212	1.134	-2.742	1.572
	(3.511)	(2.647)	(3.255)	(3.016)
AY 2018-2019	-5.219	0.263	-5.292	0.825
	(3.821)	(2.930)	(3.506)	(3.338)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Constant	-32.674	50.128*	-20.874	31.991
	(40.360)	(22.796)	(37.936)	(24.968)
Sample Size	2358	3556	2901	3013
R-Squared	0.99	0.99	0.99	0.99
Fixed Effects vs. Pooled (F-Test)	467.05***	1604.62***	1469.78***	5114.96***
Fixed vs. Random Effects (χ^2)	178.47***	227.86***	197.78***	207.40***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix D.2: The Relationship between Tuition Discounting and Full-time Freshmen Enrollment with Different Institutional Selectivity Levels

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Tuition Discount Rate	0.002	0.010	-0.007	0.014
	(0.025)	(0.015)	(0.022)	(0.016)
Tuition/fee: In-state[a]	-0.060***	-0.006	-0.044***	-0.018
	(0.015)	(0.011)	(0.012)	(0.012)
Tuition/fee: Out-of-state[a]	0.044***	0.014***	0.036***	0.015**
	(0.009)	(0.004)	(0.007)	(0.005)
Avg Amt Grant from State/local Govt[b]	0.121	-0.150+	0.024	-0.122
	(0.121)	(0.084)	(0.107)	(0.093)
Avg Amt of Federal Grant[b]	-0.463+	-0.261	-0.397	-0.224
	(0.278)	(0.199)	(0.259)	(0.204)
Avg Amt of Loan[b]	0.330	0.393*	0.316	0.394*
	(0.204)	(0.169)	(0.195)	(0.174)
75th percentile SAT/ACT Math scores	0.003	-0.004	0.002	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)
No SAT Score	-0.220	0.992+	-0.413	0.955+
	(0.550)	(0.509)	(0.484)	(0.491)
Acceptance Rate	-0.008	0.002	0.003	0.002
	(0.011)	(0.012)	(0.009)	(0.014)
Personal Income per Capita	0.152+	0.037	0.148*	0.061
	(0.084)	(0.047)	(0.073)	(0.048)
Unemployment Rate	-0.415*	0.060	-0.314*	0.164
	(0.171)	(0.111)	(0.150)	(0.118)
Poverty Rate	-0.022	-0.076+	0.006	-0.066
	(0.058)	(0.043)	(0.053)	(0.045)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Pct: Black Pop 18-24	-5.074	33.131	-16.676	56.156+
	(33.586)	(31.060)	(32.913)	(33.964)
Pct: Hispanic Pop 18-24	107.505***	27.079	106.603***	27.977
	(27.076)	(19.367)	(24.589)	(20.328)
AY 2009-2010	1.507*	0.009	0.909+	-0.028
	(0.604)	(0.329)	(0.543)	(0.340)
AY 2010-2011	1.558*	-0.154	0.920	-0.319
	(0.695)	(0.369)	(0.610)	(0.382)
AY 2011-2012	1.456*	0.170	0.752	-0.058
	(0.671)	(0.373)	(0.592)	(0.388)
AY 2012-2013	1.113+	-0.260	0.484	-0.342
	(0.655)	(0.411)	(0.588)	(0.433)
AY 2013-2014	1.013	-0.466	0.580	-0.564
	(0.631)	(0.450)	(0.564)	(0.493)
AY 2014-2015	0.456	-0.373	0.091	-0.415
	(0.594)	(0.523)	(0.544)	(0.575)
AY 2015-2016	-0.341	-0.328	-0.443	-0.379
	(0.745)	(0.599)	(0.664)	(0.669)
AY 2016-2017	-0.299	-0.664	-0.541	-0.668
	(0.840)	(0.658)	(0.733)	(0.741)
AY 2017-2018	-0.511	-0.466	-0.571	-0.451
	(0.910)	(0.709)	(0.792)	(0.801)
AY 2018-2019	-0.787	-0.424	-0.828	-0.364
	(1.008)	(0.766)	(0.870)	(0.863)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Constant	-8.697	6.327	-5.849	-0.112
	(10.216)	(6.264)	(9.351)	(6.836)
Sample Size	2358	3556	2901	3013
R-Squared	0.98	0.98	0.98	0.98
Fixed Effects vs. Pooled (F-Test)	2224.64***	4788.36***	5121.05***	2847.48***
Fixed vs. Random Effects (χ^2)	146.85***	193.66***	159.18***	177.76***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix D.3: The Relationship between Tuition Discounting and Underrepresented Minority Student Percentage with Different Institutional Selectivity Levels

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Tuition Discount Rate	-0.027	0.014	0.010	-0.021
	(0.038)	(0.040)	(0.038)	(0.036)
Tuition/fee: In-state[a]	0.032	0.010	0.040*	0.018
	(0.022)	(0.017)	(0.020)	(0.021)
Tuition/fee: Out-of-state[a]	-0.020+	-0.001	-0.019+	-0.001
	(0.012)	(0.009)	(0.010)	(0.009)
Avg Amt Grant from State/local Govt[b]	0.473*	0.059	0.319+	0.116
	(0.200)	(0.137)	(0.187)	(0.122)
Avg Amt of Federal Grant[b]	0.052	0.965**	0.215	0.818*
	(0.372)	(0.324)	(0.378)	(0.327)
Avg Amt of Loan[b]	-0.129	-0.668*	-0.196	-0.695*
	(0.334)	(0.300)	(0.336)	(0.298)
75th percentile SAT/ACT Math scores	-0.023**	0.003	-0.019*	-0.002
	(0.009)	(0.007)	(0.008)	(0.007)
No SAT Score	1.845	2.773**	1.745	3.278**
	(1.356)	(0.909)	(1.204)	(0.995)
Acceptance Rate	-0.064*	-0.007	-0.057**	-0.001
	(0.025)	(0.033)	(0.020)	(0.027)
Personal Income per Capita	0.058	0.107	0.119	0.082
	(0.131)	(0.128)	(0.127)	(0.134)
Unemployment Rate	-0.840**	-0.251	-0.648*	-0.275
	(0.318)	(0.238)	(0.287)	(0.233)
Poverty Rate	0.260*	0.130	0.340**	0.076
	(0.128)	(0.084)	(0.120)	(0.091)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Pct: Black Pop 18-24	124.037*	-41.254	137.445*	-94.416+
	(60.835)	(62.248)	(59.780)	(52.551)
Pct: Hispanic Pop 18-24	187.495***	187.526***	201.104***	170.564***
	(32.611)	(25.104)	(30.969)	(25.405)
AY 2009-2010	7.435***	2.764**	6.037***	2.751*
	(1.877)	(1.067)	(1.559)	(1.207)
AY 2010-2011	3.066**	1.630+	2.126*	2.534**
	(1.069)	(0.858)	(0.980)	(0.894)
AY 2011-2012	2.800**	3.527***	1.886*	4.584***
	(0.889)	(0.927)	(0.845)	(0.889)
AY 2012-2013	2.427**	4.075***	1.720*	5.048***
	(0.822)	(1.004)	(0.856)	(0.867)
AY 2013-2014	2.398**	3.726***	1.719+	4.728***
	(0.859)	(1.084)	(0.974)	(0.888)
AY 2014-2015	1.161	3.232*	0.792	4.419***
	(0.962)	(1.254)	(1.048)	(0.988)
AY 2015-2016	1.376	3.288*	1.075	4.230***
	(1.061)	(1.386)	(1.243)	(1.083)
AY 2016-2017	1.624	3.539*	1.262	4.598***
	(1.114)	(1.455)	(1.213)	(1.166)
AY 2017-2018	1.720	3.244*	1.544	4.327***
	(1.218)	(1.539)	(1.308)	(1.204)
AY 2018-2019	1.652	3.039+	1.356	4.156**
	(1.335)	(1.623)	(1.425)	(1.281)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Constant	-1.890	-1.168	-15.771	13.151
	(15.632)	(12.182)	(15.445)	(11.283)
Sample Size	2358	3556	2901	3013
R-Squared	0.94	0.95	0.94	0.96
Fixed Effects vs. Pooled (F-Test)	962.84***	738.91***	327.87***	583.62***
Fixed vs. Random Effects (χ^2)	369.88***	300.17***	429.72***	229.03***

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01, *** p<.001
[a] In hundreds, adjusted to 2018 dollars
[b] In thousands, adjusted to 2018 dollars

Appendix D.4: The Relationship between Tuition Discounting and Low-income Student Percentage with Different Institutional Selectivity Levels

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Tuition Discount Rate	0.128***	0.030	0.127***	0.025
	(0.038)	(0.029)	(0.033)	(0.034)
Tuition/fee: In-state[a]	0.027	0.004	0.029+	0.009
	(0.020)	(0.015)	(0.017)	(0.019)
Tuition/fee: Out-of-state[a]	-0.034**	0.004	-0.027**	0.004
	(0.013)	(0.008)	(0.010)	(0.008)
Avg Amt Grant from State/local Govt[b]	-0.162	-0.228	-0.139	-0.278+
	(0.187)	(0.152)	(0.170)	(0.167)
Avg Amt of Federal Grant[b]	0.135	0.153	0.300	0.105
	(0.259)	(0.300)	(0.260)	(0.343)
Avg Amt of Loan[b]	-0.179	-0.198	-0.350	-0.168
	(0.229)	(0.240)	(0.237)	(0.275)
75th percentile SAT/ACT Math scores	-0.020+	-0.003	-0.023**	0.004
	(0.010)	(0.005)	(0.009)	(0.006)
No SAT Score	2.173*	2.074**	2.985**	1.568*
	(1.074)	(0.686)	(0.931)	(0.732)
Acceptance Rate	0.019	0.043*	0.023	0.054+
	(0.022)	(0.022)	(0.018)	(0.030)
Personal Income per Capita	0.089	-0.043	0.052	-0.100
	(0.134)	(0.110)	(0.122)	(0.120)
Unemployment Rate	-0.051	-0.335*	-0.100	-0.404*
	(0.220)	(0.164)	(0.193)	(0.179)
Poverty Rate	0.031	0.211**	0.027	0.225**
	(0.082)	(0.067)	(0.074)	(0.074)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Pct: Black Pop 18-24	-44.905	-77.513+	-54.692	-62.306
	(43.954)	(45.729)	(43.338)	(52.486)
Pct: Hispanic Pop 18-24	-70.447*	49.205*	-37.750	46.563+
	(28.590)	(24.927)	(26.294)	(27.140)
AY 2009-2010	1.381+	0.270	1.044	0.259
	(0.801)	(0.585)	(0.692)	(0.701)
AY 2010-2011	6.823***	7.101***	6.729***	7.110***
	(0.958)	(0.674)	(0.825)	(0.823)
AY 2011-2012	11.286***	12.447***	11.349***	12.710***
	(0.936)	(0.739)	(0.815)	(0.870)
AY 2012-2013	12.125***	12.908***	11.981***	13.336***
	(0.898)	(0.785)	(0.790)	(0.935)
AY 2013-2014	11.542***	11.063***	11.323***	11.133***
	(0.912)	(0.805)	(0.796)	(0.966)
AY 2014-2015	11.466***	10.583***	11.244***	10.735***
	(0.916)	(0.868)	(0.821)	(1.024)
AY 2015-2016	11.796***	10.349***	11.520***	10.405***
	(0.974)	(0.940)	(0.887)	(1.095)
AY 2016-2017	11.059***	8.844***	10.704***	8.797***
	(1.032)	(0.967)	(0.943)	(1.108)
AY 2017-2018	11.019***	7.796***	10.636***	7.704***
	(1.117)	(1.017)	(1.017)	(1.164)
AY 2018-2019	13.437***	8.878***	12.778***	8.868***
	(1.271)	(1.112)	(1.146)	(1.259)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Constant	63.088***	35.091***	60.216***	31.568**
	(13.090)	(9.984)	(12.282)	(11.069)
Sample Size	2358	3556	2901	3013
R-Squared	0.96	0.94	0.96	0.93
Fixed Effects vs. Pooled (F-Test)	355.75***	443.46***	702.82***	306.80***
Fixed vs. Random Effects (χ^2)	534.27***	646.75***	670.78***	583.59***

Standard errors in parentheses
+ p<.10, * p<.05, ** p<.01, *** p<.001
[a] In hundreds, adjusted to 2018 dollars
[b] In thousands, adjusted to 2018 dollars

Appendix D.5: The Relationship between Tuition Discounting and Non-resident Student Percentage with Different Institutional Selectivity Levels

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Tuition Discount Rate	-0.008	0.064+	-0.021	0.085+
	(0.048)	(0.038)	(0.042)	(0.043)
Tuition/fee: In-state[a]	-0.016	-0.014	-0.007	-0.013
	(0.019)	(0.020)	(0.016)	(0.026)
Tuition/fee: Out-of-state[a]	0.028**	0.012	0.020*	0.015
	(0.010)	(0.012)	(0.009)	(0.015)
Avg Amt Grant from State/local Govt[b]	0.259	0.124	0.188	0.083
	(0.176)	(0.137)	(0.159)	(0.151)
Avg Amt of Federal Grant[b]	-0.354	-1.038*	-0.314	-1.178*
	(0.406)	(0.484)	(0.364)	(0.590)
Avg Amt of Loan[b]	0.498*	0.875*	0.535*	0.995+
	(0.245)	(0.429)	(0.225)	(0.532)
75th percentile SAT/ACT Math scores	-0.008	0.064+	0.001	0.003
	(0.048)	(0.038)	(0.007)	(0.010)
No SAT Score	-0.016	-0.014	-0.294	-2.231*
	(0.019)	(0.020)	(0.600)	(1.032)
Acceptance Rate	0.028**	0.012	-0.064***	-0.029
	(0.010)	(0.012)	(0.018)	(0.034)
Personal Income per Capita	0.259	0.124	0.139	0.339*
	(0.176)	(0.137)	(0.131)	(0.158)
Unemployment Rate	-0.354	-1.038*	-0.550**	-0.119
	(0.406)	(0.484)	(0.212)	(0.252)
Poverty Rate	0.498*	0.875*	-0.139	-0.097
	(0.245)	(0.429)	(0.094)	(0.093)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Pct: Black Pop 18-24	48.720	85.815+	34.051	83.355
	(61.702)	(48.832)	(62.001)	(59.711)
Pct: Hispanic Pop 18-24	93.333**	15.532	71.717*	16.472
	(32.546)	(26.372)	(29.702)	(29.606)
AY 2009-2010	1.842+	1.313	1.512+	1.692
	(0.987)	(0.986)	(0.834)	(1.149)
AY 2010-2011	1.319	-0.158	1.081	-0.167
	(1.161)	(0.999)	(1.027)	(1.161)
AY 2011-2012	0.137	-0.481	0.027	-0.227
	(1.100)	(0.893)	(1.000)	(1.101)
AY 2012-2013	-0.054	-0.546	-0.134	-0.368
	(1.116)	(0.835)	(1.026)	(1.046)
AY 2013-2014	-0.808	-1.050	-0.886	-0.688
	(1.013)	(0.867)	(0.900)	(1.057)
AY 2014-2015	-1.910+	-1.069	-1.638+	-0.836
	(1.002)	(0.870)	(0.921)	(1.074)
AY 2015-2016	-3.222**	-1.622	-2.659*	-1.488
	(1.161)	(1.020)	(1.080)	(1.236)
AY 2016-2017	-3.679**	-1.458	-3.044**	-1.334
	(1.259)	(1.104)	(1.131)	(1.342)
AY 2017-2018	-3.509**	-1.562	-3.000*	-1.327
	(1.314)	(1.168)	(1.169)	(1.402)
AY 2018-2019	-4.402**	-2.519*	-3.786**	-2.478
	(1.460)	(1.280)	(1.294)	(1.531)

	Acceptance >70		Acceptance>75	
	More selective	**Less selective**	**More selective**	**Less selective**
Constant	-15.576	-11.549	-8.339	-13.827
	(15.728)	(11.499)	(15.952)	(15.323)
Sample Size	2358	3556	2901	3013
R-Squared	0.92	0.93	0.92	0.93
Fixed Effects vs. Pooled (F-Test)	667.65***	567.25***	1669.91***	1032.80***
Fixed vs. Random Effects (χ^2)	98.13***	81.87***	113.54***	55.64***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix E.1: The Relationship between Tuition Discounting and Full-time Undergraduate Enrollment Excluding Year 2010

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Tuition Discount Rate	0.146*	0.133*	0.064	0.050	0.018
	(0.064)	(0.063)	(0.057)	(0.080)	(0.055)
Tuition/fee: In-state[a]	-0.046	-0.046	-0.063	-0.135**	0.007
	(0.040)	(0.039)	(0.039)	(0.051)	(0.051)
Tuition/fee: Out-of-state[a]	0.104***	0.101***	0.105***	0.132***	0.046*
	(0.020)	(0.020)	(0.020)	(0.031)	(0.019)
Avg Amt Grant from State/local Govt[b]	-0.047	-0.047	-0.162	-0.393	-0.439
	(0.268)	(0.266)	(0.257)	(0.367)	(0.356)
Avg Amt of Federal Grant[b]	-0.301	-0.314	-0.406	-0.534	-0.356
	(0.706)	(0.701)	(0.736)	(0.944)	(0.947)
Avg Amt of Loan[b]	0.639	0.645	0.782	0.623	0.890
	(0.605)	(0.600)	(0.645)	(0.786)	(0.852)
75th percentile SAT/ACT Math scores		0.021*	0.022*	0.023*	-0.030
		(0.010)	(0.010)	(0.011)	(0.020)
No SAT Score		2.807+	1.828	-1.579	4.332**
		(1.583)	(1.471)	(1.626)	(1.668)
Acceptance Rate		-0.038	-0.019	-0.023	0.066
		(0.025)	(0.022)	(0.042)	(0.081)
Personal Income per Capita			0.383*	0.498+	0.188
			(0.191)	(0.266)	(0.183)
Unemployment Rate			-0.719*	-1.177*	0.494
			(0.344)	(0.477)	(0.463)
Poverty Rate			-0.225	-0.021	-0.219
			(0.140)	(0.181)	(0.140)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Pct: Black Pop 18-24			-183.393*	-79.243	170.226
			(85.560)	(119.099)	(145.649)
Pct: Hispanic Pop 18-24			198.982**	453.757***	19.569
			(66.936)	(89.444)	(102.493)
AY 2009-2010	2.479***	2.455***	5.414***	5.921***	2.677+
	(0.353)	(0.357)	(1.150)	(1.661)	(1.394)
AY 2011-2012	5.289***	5.304***	7.528***	6.324***	4.449**
	(0.576)	(0.582)	(1.276)	(1.893)	(1.595)
AY 2012-2013	5.211***	5.284***	6.885***	5.367**	3.193+
	(0.618)	(0.620)	(1.324)	(1.935)	(1.878)
AY 2013-2014	4.709***	4.833***	5.993***	4.638*	1.575
	(0.706)	(0.705)	(1.389)	(2.009)	(1.984)
AY 2014-2015	4.999***	5.077***	4.626**	2.634	1.411
	(0.771)	(0.770)	(1.523)	(2.116)	(2.471)
AY 2015-2016	5.123***	5.202***	2.702	0.371	0.837
	(0.860)	(0.860)	(1.809)	(2.549)	(2.906)
AY 2016-2017	5.515***	5.661***	1.919	-0.707	0.698
	(0.955)	(0.960)	(1.975)	(2.783)	(3.258)
AY 2017-2018	6.362***	6.235***	1.012	-1.666	1.146
	(1.020)	(0.993)	(2.122)	(2.880)	(3.640)
AY 2018-2019	6.372***	6.244***	-0.731	-3.485	0.471
	(1.124)	(1.092)	(2.374)	(3.137)	(3.988)
Constant	61.877***	52.276***	37.946+	-10.285	26.120
	(3.363)	(6.858)	(20.925)	(32.743)	(30.827)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Sample Size	5464	5464	5464	3104	2360
R-Squared	0.99	0.99	0.99	0.99	0.99
Fixed Effects vs. Pooled (F-Test)	239.84***	754.87***	7289.34***	4820.98***	2989.08***
Fixed vs. Random Effects (χ^2)	234.37***	305.84***	343.39***	195.14***	175.68***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars

Appendix E.2: The Relationship between Tuition Discounting and Full-time Freshmen Enrollment Excluding Year 2010

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Tuition Discount Rate	0.019	0.017	0.003	-0.011	0.001
	(0.015)	(0.015)	(0.015)	(0.021)	(0.016)
Tuition/fee: In-state[a]	-0.015	-0.015	-0.019+	-0.033*	-0.009
	(0.010)	(0.010)	(0.010)	(0.013)	(0.014)
Tuition/fee: Out-of-state[a]	0.026***	0.026***	0.026***	0.032***	0.015**
	(0.005)	(0.005)	(0.005)	(0.007)	(0.005)
Avg Amt Grant from State/local Govt[b]	0.049	0.049	0.024	0.028	-0.070
	(0.080)	(0.080)	(0.078)	(0.116)	(0.088)
Avg Amt of Federal Grant[b]	-0.231	-0.232	-0.258	-0.326	-0.320
	(0.162)	(0.161)	(0.171)	(0.227)	(0.209)
Avg Amt of Loan[b]	0.291*	0.292*	0.328*	0.314+	0.417*
	(0.136)	(0.136)	(0.146)	(0.170)	(0.176)
75th percentile SAT/ACT Math scores		0.004	0.004	0.001	-0.003
		(0.003)	(0.003)	(0.003)	(0.004)
No SAT Score		0.596	0.396	-0.022	0.840
		(0.446)	(0.424)	(0.471)	(0.548)
Acceptance Rate		0.000	0.004	0.007	0.019
		(0.006)	(0.006)	(0.010)	(0.020)
Personal Income per Capita			0.095*	0.109+	0.079+
			(0.045)	(0.065)	(0.044)
Unemployment Rate			-0.138	-0.209	0.174
			(0.091)	(0.133)	(0.125)
Poverty Rate			-0.063+	-0.024	-0.069
			(0.037)	(0.047)	(0.046)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Pct: Black Pop 18-24			-29.940	-4.297	54.341
			(22.328)	(30.430)	(37.687)
Pct: Hispanic Pop 18-24			44.994**	101.504***	23.320
			(15.732)	(22.800)	(21.207)
AY 2009-2010	0.091	0.092	0.693*	0.504	0.220
	(0.116)	(0.117)	(0.305)	(0.473)	(0.366)
AY 2011-2012	0.501**	0.516**	0.892**	0.448	-0.011
	(0.161)	(0.161)	(0.337)	(0.510)	(0.418)
AY 2012-2013	0.375*	0.395*	0.619+	0.208	-0.489
	(0.173)	(0.172)	(0.341)	(0.508)	(0.487)
AY 2013-2014	0.508**	0.529**	0.645+	0.237	-0.616
	(0.191)	(0.190)	(0.350)	(0.490)	(0.549)
AY 2014-2015	0.729***	0.735***	0.504	0.050	-0.590
	(0.199)	(0.198)	(0.375)	(0.494)	(0.649)
AY 2015-2016	0.876***	0.885***	0.181	-0.403	-0.642
	(0.218)	(0.218)	(0.442)	(0.601)	(0.740)
AY 2016-2017	1.014***	1.026***	0.046	-0.532	-0.709
	(0.252)	(0.252)	(0.484)	(0.667)	(0.815)
AY 2017-2018	1.330***	1.286***	-0.014	-0.518	-0.625
	(0.259)	(0.256)	(0.521)	(0.720)	(0.880)
AY 2018-2019	1.595***	1.544***	-0.148	-0.399	-0.743
	(0.286)	(0.281)	(0.576)	(0.784)	(0.947)
Constant	13.078***	10.744***	5.404	-4.807	-2.588
	(0.819)	(1.659)	(5.334)	(8.133)	(7.619)

	All Sample			By Subsector	
	M1	**M2**	**M3**	**Selective Inst.**	**Non-selective Inst.**
Sample Size	5464	5464	5464	3104	2360
R-Squared	0.98	0.98	0.98	0.98	0.98
Fixed Effects vs. Pooled (F-Test)	214.50***	790.00***	6234.61***	886.88***	2614.77***
Fixed vs. Random Effects (χ^2)	187.82***	256.97***	275.18***	164.56***	162.92***

Standard errors in parentheses

+ p<.10, * p<.05, ** p<.01, *** p<.001

[a] In hundreds, adjusted to 2018 dollars

[b] In thousands, adjusted to 2018 dollars