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Institutional Aid and Net Tuition Revenue:
Understanding the Relationship Across
Private Institutions of Different
Carnegie Classifications

Warren Patrick Jude Lord

Dissertation Committee:
Dr. Rong Chen, Mentor
Dr. Robert Kelchen, Committee Member
Dr. Alyssa McCloud, Committee Member

Submitted in partial fulfillment
for the requirements for the degree of
Doctor of Education
Seton Hall University
2018

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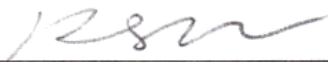
SETON HALL UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN SERVICES
OFFICE OF GRADUATE STUDIES

APPROVAL FOR SUCCESSFUL DEFENSE

Warren P. Lord, has successfully defended and made the required modifications to the text of the doctoral dissertation for the **Ed.D.** during this **Spring Semester 2018**.

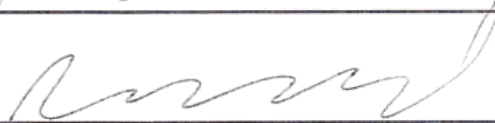
DISSERTATION COMMITTEE
(please sign and date beside your name)

Mentor:
Dr. Rong Chen



5/7/2018

Committee Member:
Dr. Alyssa McCloud



5/7/18

Committee Member:
Dr. Robert Kelchen



5/7/18

The mentor and any other committee members who wish to review revisions will sign and date this document only when revisions have been completed. Please return this form to the Office of Graduate Studies, where it will be placed in the candidate's file and submit a copy with your final dissertation to be bound as page number two.

Abstract

Private nonprofit four-year institutions have been increasing the amount of institutional aid provided to students, in the pursuit of enrollment and revenue management objectives and goals. Most of this aid is being funded using the institution's operating funds. This study investigated the relationship between unfunded institutional aid and net tuition revenue, controlling for institutional characteristics and financial factors. The study was based on panel data analysis using Delta Cost Project data from 2006 to 2015. The findings of this study show that the relationship between unfunded institutional aid and net tuition revenue varies by Carnegie classification. Private nonprofit Bachelor's institutions can increase net tuition revenue using unfunded institutional aid, but this relationship has a peak of 39%. This study also reviewed other factors that are associated with increasing net tuition revenue.

Keywords: institutional aid, net tuition revenue, revenue generation, private nonprofit four-year, discount rate, unfunded discount rate, Carnegie Classification, tuition discounting

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Dedication

To my parents;

My wife, Connie;

And my children, Peter, JohnPaul, RoseMary, and Joseph.

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CHAPTER 1

INTRODUCTION

Problem Statement

Private nonprofit higher education institutions are spending more on institutional aid than before. The average institutional grant aid per first-time full-time undergraduate student in 2014 dollars jumped from \$8,850 in 2004-2005 to \$15,080 in 2014-2015 at Bachelor's level private nonprofit institutions. Similarly, Master's and Doctoral private nonprofit institutions had an increase from \$7,720 and \$10,660 to \$13,920 and \$16,650 respectively during the same 10-year period. First-time full-time students at private nonprofit institutions received 80% of their grant aid from their institutions in 2014-2015. In 2014-2015, 73% of first-time full-time undergraduate students at private nonprofit Doctoral institutions received some amount of institutional aid, that number was 92% at private nonprofit Master's institutions, and 84% at private nonprofit Bachelor's institutions. Colleges and universities spent \$58.7 billion in institutional grant aid in 2016-2017, which was a 32% increase from \$44.4 billion (in 2016 dollars) in 2011-2012 (College Board, 2017b).

Institutional grant aid is used to attract a sufficient number of students to the institution, and to fulfill enrollment and revenue management objectives. Institutional aid is used as a strategic tool to “craft a class” based on institutional objectives (Baum, Lapovsky, & Ma, 2010; Hillman, 2012). The institutional objectives can include making the institution more affordable, bringing in students with particular talents to improve the academic profile, increasing diversity, improving athletics, achieving enrollment targets, increasing tuition revenue, and promoting other characteristics that align with the mission of the institution (Hillman, 2012; Summers,

2004). Essentially, institutional aid is offered to those who are unable or unwilling to pay the price, and to entice otherwise indifferent students to enroll (Baum, Lapovsky, & Ma, 2010).

Institutions use restricted and unrestricted funds for institutional aid. Institutions provide institutional aid using two types of sources. The desired source of funding is funds restricted to financial aid, such as endowment earnings from restricted gifts, and gifts from third parties restricted to institutional aid. This type of institutional aid is referred to as funded aid. The less desired source, but unfortunately the primary source, is institutional operating funds. This is the case even at institutions with the largest endowments (NACUBO, 2017). In the NACUBO 2017 study, only 10.7% of all undergraduate institutional aid was funded by endowment funds in 2016-2017. Essentially, there is no dedicated revenue source to support the vast majority of the institutional aid. This type of aid has an opportunity cost since these funds can be used for any purpose. This source is referred to as unfunded aid. Institutions use funded and unfunded institutional aid as tools to encourage student enrollment decisions, and thereby increase tuition revenue (Hillman, 2012).

One of the metrics commonly used to measure tuition revenue is net tuition revenue, and is calculated as the gross tuition and fee revenue minus institutional grant aid (NACUBO, 2017). Despite the increase in institutional aid, institutions have not experienced the expected increase in enrollment and gains in net tuition revenue. A common indicator used to measure the institutional aid provided by educational institutions is the discount rate, which is defined as the total amount of institutional grant dollars as a percentage of the gross tuition and fee revenue (NACUBO, 2017). The 2017 NACUBO tuition discounting study, which surveys private nonprofit four-year educational institutions, showed that rising discount rates have slowed net tuition revenue growth. The average discount rate for first-time full-time freshmen is expected

to reach 49.9% in 2017-2018, leading to a negative net tuition revenue growth of 0.1% in 2017-2018 for that group. The study also indicates that net tuition revenue has been flat or declining for the last five years, in constant dollars.

Many private four-year nonprofit institutions are dependent on tuition revenue as the major share of their budget. In fiscal year 2015, these institutions derived 35% of revenue from tuition and fees (*The Almanac of Higher Education*, 2017). In 2014-2015, *The Almanac of Higher Education* showed that 112 private nonprofit four-year institutions failed to receive the passing score on the financial health standards test administered by the United States Department of Education. This test is based on net worth, operating losses, and the relationship between assets and liabilities. Therefore, declines in net tuition revenue without additional streams of revenue can have a serious impact on institutional finances, and may impact an institution's financial health.

Private nonprofit institutions are more dependent on net tuition revenue than are public institutions. *The Almanac of Higher Education* (2017) shows that, while 35% of the revenue at private nonprofit institutions is derived from tuition and fees, in public four-year institutions, tuition and fees account for only 22% of revenue. Published tuition and fees rose from \$19,920 to \$33,480 at private nonprofit four-year institutions from 1996-1997 to 2016-2017 (in constant dollars), but the net tuition and fees paid by the average student increased from \$11,800 to \$14,190 during that period. This means that the 68.1% increase in published tuition and fees was largely paid by grants, and students only saw a 20.3% increase in their tuition and fees. Public four-year institutions performed better during that time, with published tuition and fees rising from \$4,560 to \$9,650, and the net tuition and fees paid increasing from \$2,340 to \$3,770 (*The Almanac of Higher Education*, 2017). In 2015-2016, public four-year nonprofit institutions gave

an average of \$4,900 in institutional grant aid per undergraduate student, whereas at private four-year nonprofit institutions the average undergraduate institutional grant was \$16,100 (Radwin et al., 2018). This shows that the impact of institutional aid and net tuition revenue are more pronounced at private nonprofit four-year institutions.

An increase in sticker price is typically associated with more institutional aid to meet enrollment goals (Breneman, 1994). Between 2009-2010 and 2014-2015, tuition rose from \$35,720 (in 2014 dollars) to \$39,070 at private Doctoral institutions, while institutional aid increased from \$14,280 to \$16,650 (College Board, 2017b). This means that the increase of \$3,350 in tuition was partially offset by institutional aid of \$2,370. For Master's institutions during that period, tuition rose by \$1,660 but was more than offset by \$3,100 in institutional grant aid. For Bachelor's institutions during that period, tuition rose by \$3,510 but was partially offset by \$3,390 in institutional grant aid. However, when Chief Business Officers (CBOs) were asked what strategies they used to increase tuition revenue, 79% indicated they implemented new student recruitment strategies, 73% used student retention strategies, and 64% used financial aid related strategies (NACUBO, 2017). Despite increasing institutional aid, and implementing changes to recruitment, retention, and financial aid strategies, 53% of institutions experienced loss or no gain in total undergraduate enrollment (NACUBO, 2017).

Research on the impact of institutional aid on net tuition revenue has been minimal and the results have been mixed. Redd (2000) found that tuition discounting can be used to generate net tuition revenue at private nonprofit four-year institutions, but the discount rate in 1996-97 should not exceed 13.1% more than that in 1990-91. Institutions having more than a 13.1% change in the discount rate showed a decline in net tuition revenue. However, Summers' (2004) study of selected liberal arts colleges indicated that there was a linear relationship between

institutional aid and net tuition revenue without a peak. Contrary to these studies, Behaunek's (2015) study of baccalaureate private institutions did not show a positive relationship between net tuition revenue and the tuition discount rate. The NACUBO Tuition Discounting Study of private educational institutions showed that, despite increasing discount rates, the average annual percentage change of net tuition revenue for first-time full-time freshman in current dollars decreased from 5.9% in 2006-2007 to -0.1% in 2017-2018, with wide variations between those years (NACUBO, 2017). A closer review of net tuition revenue shows that there is a variation by NACUBO constituent groups. In 2017-2018, even though the net tuition revenue change was -0.1% overall, small institutions reported a -1.1% change, while research institutions reported a 1.9% gain, and comprehensive institutions a 1% gain. The trend was the same in 2016-2017, with small institutions reporting the lowest gain of 2.5%, research institutions the most with 4.7%, and comprehensive institutions at 4.2%. This is concerning since small institutions provide more aid as a percentage of tuition than do the other constituent groups (NACUBO, 2017). Hillman's (2012) study of the impact of institutional aid on net tuition revenue at public institutions showed that net tuition revenue increased at institutions with tuition discount rates up to 13%, but decreased at institutions with discount rates that were higher.

A few studies have been conducted on net tuition revenue and its relationship to unfunded institutional aid (Behaunek, 2015; Hillman, 2012), but none has studied this in relation to how it varies based on Carnegie classification in the last 15 years. The last similar study was conducted by Martin (2002) using Integrated Postsecondary Education Data System (IPEDS) data from 1994-1995 to 1996-1997 using a simultaneous equation model, which showed that institutional marginal revenue when enrolling students, varies by Carnegie classification, and so do the institutional marginal costs. The study also showed that tuition and fee elasticities vary by

Carnegie classification. My study serves to fill this void, by using quantitative analysis to study the relationship between unfunded institutional aid and net tuition revenue at private nonprofit four-year institutions, and investigate how this relationship varies by Carnegie classification.

Research Questions

1. How does unfunded institutional aid relate to net tuition revenue for private nonprofit four-year and above institutions?
2. Does the relationship vary by Carnegie classification? If so, how?
3. What other factors contribute to net tuition revenue?

Significance of the Study

Private nonprofit higher education institutions rely on tuition revenue as a significant part of the budget. Declining net tuition revenue can be a strain on the institutional financial health, causing a negative impact on operations, and may hamper the fulfillment of the institutional mission. Therefore, it is imperative that these institutions understand what contributes to net tuition revenue growth, and particularly, the limits of the benefits of using unfunded institutional aid in this endeavor.

Institutional leaders—particularly those tasked with enrollment management, financial aid, and finance—need to know what factors and how institutional aid can be leveraged effectively to maximize net tuition revenue. This study will provide answers that can be used in practice to grow net tuition revenue and minimize those factors that negatively impact it. As institutions continue to implement policies and strategies to achieve their enrollment and revenue management objectives, this study can serve as a guide which will help institutional leaders to make decisions grounded on empirical research.

This study will add to the literature on the impact of unfunded institutional aid on net tuition revenue at private nonprofit four-year and above institutions, and how it varies by Carnegie classification. There is a lack of literature on this subject, and this study will satisfy this need.

Outline of the Study

This chapter introduced the study. The importance of institutional aid and its impact on enrollment and institutional finances were discussed. Research questions guiding this study were presented, and their significance to educational institutions was discussed.

Chapter 2 will provide a review of literature, highlighting the research that has been done in this area. Theories and conceptual models used in research that explain the relationship between institutional aid and net tuition revenue will be presented. Institutional aid and its impact on enrollment will be explored. Factors contributing to institutional aid and net tuition revenue will be discussed.

Chapter 3 will present the methodology used in the study, including a discussion of statistical techniques, data sources, and the assumptions made. Chapter 4 will present the findings. Chapter 5 will provide conclusions based on the findings and discuss suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

Introduction

The study of institutional aid and its relationship to tuition revenue needs to take into account the wide variation among higher education institutions in terms of educational missions, resource availability, and other institutional characteristics. This chapter will discuss institutional aid and the relationship to net tuition revenue, the applicable theories, factors that contribute to increasing net tuition revenue, and prior research that has explored the factors that are known to contribute to this relationship. This chapter will conclude with the conceptual framework that will be used in this study.

Institutional Aid

Financial aid is an important factor that students consider when making enrollment decisions (Hossler, 2000). Financial aid comes in many forms, such as non-repayable grants and scholarships, repayable loans, and on-campus employment in the form of work-study funds. Non-repayable grants from institutions far exceed the grants from federal and state sources. For example, in 2014-2015, private nonprofit Doctoral institutions provided 90% of grant aid to their students, compared to 6% from federal and 4% from state sources. Similarly, private Master's institutions provided 83%, and Bachelor's institutions 84% (College Board, 2017b). Educational institutions use institutional aid as a tool to encourage students to enroll. Institutions can use general operating funds or funds restricted to financial aid, for this purpose. However, most institutions primarily use general operating funds, referred to as unfunded institutional aid (NACUBO, 2017). Unfunded institutional aid is a financial strain on institutions, since these funds could have been used to satisfy other institutional priorities. When institutional aid is

provided from institutional resources that are restricted to financial aid purposes, this is referred to as funded institutional aid. From an institution's perspective, funded institutional aid is preferable compared to unfunded institutional aid. However, funds restricted to financial aid are very limited, and institutions need to use general operational funds to provide the necessary institutional aid.

The primary source for funded institutional aid is endowment income. Endowment assets per Full-Time-Equivalent student in 2013-2014 at private nonprofit four-year institutions was \$775,700 in the highest decile group, compared to \$2,500 in the lowest decile group. The median was \$32,800 (*The Almanac of Higher Education*, 2017). Institutions typically spend 4% per year of endowment income (College Board, 2017a). The NACUBO (2017) study shows that in 2016-2017, research universities covered 21.8% of the institutional aid expenditures using endowment funds, whereas small institutions covered 10.6%, and comprehensive/Doctoral institutions covered 5%. This shows that institutions used unfunded institutional aid primarily for institutional aid.

Tuition Revenue

Many institutions rely on tuition and fees revenue to balance their budgets. Strategies that institutions use to increase tuition and fees revenue include increasing tuition and fees, increasing enrollment, and using institutional aid to encourage students to enroll (NACUBO, 2017). Between 2012-2013 and 2017-2018, the published tuition and fees have increased 13% at private nonprofit four-year institutions after adjusting for inflation (College Board, 2017a). As of 2017-2018, the average published price, also known as "sticker price" at private nonprofit institutions for full-time undergraduates by Carnegie classification, was \$42,920, \$29,960, and \$33,450 for Doctoral, Master's, and Bachelor's, respectively, following an increase of 3.8%,

3.6%, and 4.4%, respectively, from the previous year (College Board, 2017a). Increasing tuition and fees does not guarantee increased net tuition revenue. Net tuition revenue is the tuition revenue retained after the tuition discounts are subtracted. Increasing the published tuition and fees affects affordability, and institutions need to provide additional institutional aid to encourage students who would not otherwise enroll (Martin, 2002). Institutions need to take into account the “sticker shock” that can be caused, to those who are not aware that most students do not pay the “sticker price” (Haveman & Smeeding, 2006).

Enrollment increases can help to increase net tuition revenue based on the types of students being enrolled and institutional capacity to sustain the additional students (Martin, 2002). Full-pay students, while not needing any institutional aid, add to the capacity requirements for physical plant and instructional needs. Physical plant capacity includes housing, dining, classrooms, offices, and student services. Instructional capacity involves number of faculty needed to maintain the desired faculty/student ratio and the support staff needed to accommodate the additional students. If an institution has excess capacity in physical plant and instructional requirements, then full-pay students will boost tuition and fees revenue. Non-full-pay students will need additional subsidy capacity, in the form of institutional aid, and the marginal revenue gain will dictate whether the additional students will increase net tuition revenue. Essentially, for an institution to gain net tuition revenue with additional students, the marginal revenue needs to exceed the marginal cost.

Institutional aid is used as a tool to encourage students to enroll and thereby increase net tuition revenue. Studies have shown that institutional aid can be used to “craft a class” based on institutional priorities, and to increase net tuition revenue (Summers, 2004; Hillman, 2012).

Metrics Used in Prior Studies

Discount Rate: Discount rate is commonly used to measure the amount of institutional aid given to students. Discount rate is the percentage of the average tuition given back to the students as tuition discounts. Discount rate is calculated as the ratio of total institutional aid (includes funded and unfunded) expenditures to gross tuition revenue (NACUBO, 2017).

Unfunded Discount Rate: Unfunded discount rate is a measure of the amount of unfunded institutional aid used in discounting. This is calculated as the ratio of total unfunded institutional aid expenditures to gross tuition revenue (NACUBO, 2017).

Funded Discount Rate: Funded discount rate is a measure of the amount of funded institutional aid used in discounting. This is calculated as the ratio of total funded institutional aid expenditures to gross tuition revenue (NACUBO, 2017).

Net Tuition Revenue: Net tuition revenue is the tuition and fee revenue retained after the tuition discounts have been applied. This is calculated as gross tuition and fee revenue less institutional aid expenditures (NACUBO, 2017).

Theories Guiding Studies in Net Tuition Revenue

Breneman's Theory

David W. Breneman (1994) developed a microeconomic theory of the private institution and published a model that depicts tuition discounting in his book on liberal arts colleges. He suggests that an institution goes through a two-stage optimization process. In the first stage an institution decides on its enrollment target and provides inputs such as faculty, staff, facilities, etc., to maintain this level of enrollment at a financially sustainable quality. First-stage maximization is based on the long-term view. In the second-stage maximization, an institution seeks to focus on improving the quality of its inputs (student body, faculty, staff, etc.), given the

decisions about size made in the first stage within budget constraints. The determinants of the budget constraints necessarily involve total institutional revenue and net tuition revenue, since many private institutions are dependent on tuition revenue as their primary revenue stream.

Breneman illustrates his model as a downward sloping demand curve that is representative of each college at the end of its recruiting cycle (Figure 1).

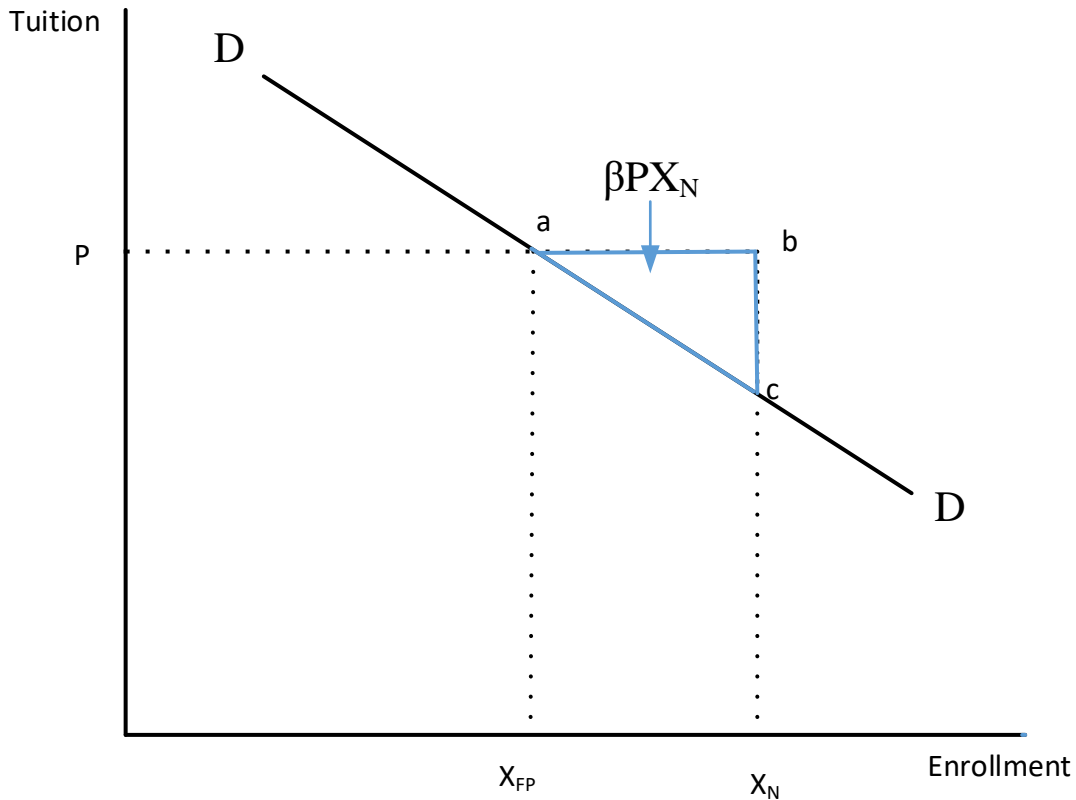


Figure 1. Enrollment demand and unfunded student aid (Breneman, 1994).

For an institution, the number of full-pays at a tuition price of P , is X_{FP} . If the institution wants an enrollment level of X_N , then the institution will need to provide unfunded institutional aid corresponding to βPX_N . β is the ratio of unfunded institutional aid to gross tuition revenue.

$$\text{Net Tuition Revenue (NTR)} = PX_N - \beta PX_N$$

The demand curve shows that given the number of students able and willing to pay the full tuition price, an institution will need to provide an amount of institutional aid to achieve its

enrollment and net tuition revenue targets. In the absence of tuition discounts, an institution will enroll fewer students and earn less net tuition revenue.

Martin's Theory

Robert E. Martin (2002) published a paper highlighting the fact that increased enrollment does not necessarily improve an institution's financial position even in the presence of excess capacity. He mentions that students do not pay the average cost incurred by the institution to provide services since the average student receives a substantial subsidy. The subsidy comes from third parties, such as public funds, endowments, or individual contributions. An institution needs to balance its enrollment with the capacity of subsidies. The marginal revenue should be higher than the marginal cost in the short and long term for an increase in enrollment to have a positive financial impact. The marginal cost depends on capacity utilization. According to Martin, higher education has at least three different types of capacity: physical plant, instructional, and subsidy capacity. When an institution seeks to increase enrollment, it needs to consider the availability of the three types of capacities and whether they are all balanced. Physical plant includes housing, dining, classroom, office, and student services capacity. Instructional capacity includes faculty to student ratios, number and size of classrooms, and support staff. Subsidy capacity includes the cost incurred by the institution, availability of endowment funds, and the type of student it intends to recruit. Subsidy capacity can be increased by lowering institutional costs, raising more endowment funds, or lowering the quality of the students it seeks to recruit. If all three capacities are balanced with the current enrollment, then the marginal cost for increasing enrollment will be the highest since this would require more physical plant, more faculty, and more endowment. Even if there is excess capacity in all three categories, the marginal cost will not be zero due the variable cost for each student recruited.

Institutions can maximize revenue by using effective scholarship policies. Students subsidize their own and other students' education costs. Students with the ability to pay and less meritorious students should cross-subsidize those with financial need and high merit. The financial impact of enrolling another student depends on the transaction cost and the marginal cost of enrolling the student. Assuming tuition and fees exceed the marginal cost of recruiting a student, and the marginal cost equals tuition and fees less the average scholarship award, then full-pay students improve an institution's financial position but weaken an institution's academic profile. In that case, recruiting students that are of the same average profile as the institution's current students has no financial impact nor will it have an effect on the institution's academic profile. Similarly, recruiting students with high merit will negatively impact an institution's financial position but improve its academic profile.

McPherson and Schapiro's Theory

McPherson and Schapiro (1998), in their book *The Student Aid Game* proposed their theory on how student aid is used for enrollment management and as a revenue management tool. They indicate that there are three approaches to awarding student aid. The first approach is "need-blind full-need." With this approach an institution makes the admission decision without regard to the student being able to pay for their education. The institution then provides 100% of student aid to satisfy the student's financial need. This approach is only taken by a few highly selective schools with large endowments. The second approach is referred to as "budget stretch." This uses a "need-blind" approach but limits the amount of student aid to a budgeted amount, since these institutions lack the financial resources of the elite institutions following the "need-blind full-need approach." The third approach is referred to as "strategic maximization." This approach is also used by institutions with limited financial resources but instead of using a

“budget stretch” approach, they admit the best students they want and aim to gain as much tuition revenue from them as possible. Many institutions have realized the importance of student aid as a strategic tool and are using financial aid strategies to maintain the institution’s financial health.

Resource Dependence Theory

Resource dependence theory asserts that an organization takes necessary actions to ensure its relationship with the external environment is effectively controlled. An organization depends on the environment for resources. An organization must try approaches such as reduce dependency, build external linkages, and enact supportive environments to effectively manage its environment and resources (Aldrich & Pfeffer, 1976). Educational institutions compete with one another to enroll students that enhance their prestige and enroll a class according to their priorities and missions. With this competition, institutions need to provide incentives in the form of student aid to encourage enrollment decisions (Browning, 2011). Resource dependence theory provides an effective framework to identify the forces and institutional responses to minimize negative effects. Many institutions are tuition dependent and may use many strategies to diversify their sources of revenue. This includes diversifying their pool of applicants to include full-pay international students (Cantwell, 2015; Hegarty, 2014).

Nonprofit Firm Behavior

Hillman (2012) studied how tuition discounting affected net tuition revenue in public four-year institutions. He used the microeconomic theory of nonprofit firm behavior as the conceptual framework for the study. This framework suggests that educational institutions strive to maximize their “utility” by focusing their resources on their unique social and educational missions. One common “utility” all institutions strive to maximize is reputation and prestige. In

order achieve this, institutions provide financial aid to entice desired students to enroll at their institution. Institutions design tuition discounting strategies—including enticing students who meet certain criteria regarding SAT scores, residency status, race/ethnic diversity, or socioeconomic status—to enroll students to maximize the institutions' reputation and prestige.

Summary of the Theories

The theories above apply to net tuition revenue and its relationship to unfunded institutional aid and other factors. Breneman's theory highlighted the fact that institutions seek to enhance their reputation and services based on budgetary constraints and predetermined enrollment capacity. Institutions provide the necessary institutional aid to enroll the number of students according to their budgeted model. Martin's theory highlighted the need to enroll students based capacity utilization. Subsidy capacity is based on the available unfunded and funded institutional aid, and endowment income. The physical plant capacity relates to the availability of facilities, dining, housing, and expenditures for student services. The instructional capacity relates to the expenditures on instructional expenses. McPherson and Schapiro's theory highlighted the need to be strategic in allocating student aid, to ensure that the distribution provides for an effective return on the allocated resources and that the provision of aid is within the budgetary constraints for institutional aid. The resource dependency theory provides a framework to examine institutional responses to managing institutions' resources and the external environment effectively. Institutions seek to maximize tuition revenue, prestige, and rankings using the resources available to them. Improving institutional ranking and prestige requires more merit-based aid to recruit students with the institution's desired skills and credentials.

This study will draw upon all the theories discussed. This study will look at the relationship among net tuition revenue, institutional characteristics, and institutional financial factors. Institutional characteristics will encompass admissions selectivity, student demographics, undergraduate and graduate enrollment, and how they vary by Carnegie classification. Institutional financial factors will include expenditures on institutional aid, published tuition amount, endowment income, expenditures on instruction, and expenditures for student services.

Review of the Literature

Studies on tuition discounting for revenue management are limited compared to the many studies done on tuition discounting for enrollment management. Since this study will focus on tuition discounting for revenue management, the literature review will not address tuition discounting for enrollment management. The literature on tuition discounting for revenue management focuses on net tuition revenue. The literature highlights two categories of factors that contribute to this relationship. The categories are institutional characteristics and institutional financial factors. I will discuss each of the factors in these categories and provide empirical evidence from the research studies.

Institutional Characteristics

Institutional characteristics play an important part in enrollment decisions, and how much aid an institution needs to provide to enroll the desired students to fit the intended academic profile. The following factors have been identified.

Selectivity. Selectivity is the number of applicants who were admitted to an institution, also known as admit rate. A low admit rate indicates high selectivity. High selectivity shows that many students desire to enroll at that institution. Highly selective institutions use

institutional aid to entice desirable students to enroll at their institutions (Browning, 2011). In a study that looked at the relationship of institutional aid to net tuition revenue at public four-year institutions, Hillman (2012) found that selectivity ($\beta=-354.017$, $p<.001$) is a significant controlling variable associated with net tuition revenue per full-time equivalent (FTE) as the dependent variable.

SAT (Math and Verbal) 75th percentile score. Institutions seek to enhance their reputations by enrolling students with high academic achievement. The competition for high academic achievers requires institutions to provide significant merit aid, increasing institutional aid expenditures. In Hillman's (2012) study discussed earlier, the median SAT score of the incoming cohort ($\beta=1.143$, $p<.001$) was found to be a significant controlling variable associated with net tuition revenue per FTE as the dependent variable.

Undergraduate and graduate enrollment. Doctoral and Master's institutions enroll graduate and undergraduate students, while Bachelor's institutions almost exclusively enroll undergraduate students. Undergraduate and graduate enrollment affects institutional budgets differently, since the average expenditures for graduate education is higher than for undergraduate education (College Board, 2017a). Graduate students play a role in undergraduate education by serving as instructors, teaching assistants, and lab assistants.

Student Demographics

Percentage Pell. Percentage of Pell Grants compared to all grants indicates the percentage of low-income enrollment. In Hillman's (2012) study of public four-year institutions, the percentage of Pell Grant recipients ($\beta=1834.41$, $p<.05$) was a significant control variable in the relationship between institutional aid and net tuition revenue.

Percentage of non-resident international student enrollment. Non-resident international student enrollment provides an institution with a stream of full-pay students. Cantwell (2015) studied the relationship of new international undergraduate enrollment to net tuition revenue at public four-year institutions. Results show that Doctoral universities increased their net tuition revenue with the increase in international student enrollment ($\beta=0.369$, $p<.01$). However, Bachelor's and Master's institutions did not gain net tuition revenue by enrolling additional international undergraduate students.

Carnegie Classification. The Delta Cost Project data, which is derived from the IPEDS data, show that net tuition revenue varied by Carnegie classification between 2003 to 2013 (Desrochers & Hurlburt, 2016). The 2010 Carnegie classification categorizes Doctoral institutions as those that grant at least 20 research doctoral degrees a year, Master's institutions as those that grant at least 50 master's degrees and less than 20 doctoral degrees, and Bachelor's institutions as those that grant at least 10% of degrees that are bachelor's, fewer than 50 master's degrees, and fewer than 20 doctoral degrees. The analysis of the Delta Cost Project data between 2003 to 2013 shows that Doctoral institutions gained the highest amount of net tuition revenue, followed by Master's institutions, and the Bachelor's institutions deriving the least (Desrochers & Hurlburt, 2016). The NACUBO (2017) study also showed that net tuition revenue varied by constituent groups: Research, Comprehensive, and Small Institutions (Table 1). Even though small institutions provide the highest discount rate, these institutions see the lowest net tuition revenue annual percent change. This shows that factors associated with Carnegie classification groups and institutional characteristics play a significant role in net tuition revenue.

Table 1

Tuition Discount Rate and Net Tuition Revenue for First-Time Full-Time Freshmen (NACUBO 2017)

Tuition Discount Rate	2014-15	2015-16	2016-17	2017-18
Comprehensive	42.90%	43.30%	44.20%	44.40%
Research	43.20%	42.40%	43.30%	44.10%
Small Institutions	48.50%	49.50%	49.90%	51.70%
All Institutions	47.10%	48.00%	48.20%	49.90%
Net Tuition Revenue Pct Change	2014-15	2015-16	2016-17	2017-18
Comprehensive	0.90%	3.70%	4.20%	1.00%
Research	8.40%	2.20%	4.70%	1.90%
Small Institutions	0.00%	1.50%	2.50%	-1.10%
All Institutions	2.10%	1.50%	2.80%	-0.10%

Institutional Financial Factors

Financial resources play an important role in how an institution can respond to the external environment. Highly endowed and selective institutions can use their financial resources to “craft a class” based on institutional mission without affecting their financial strength.

Institutional financial resources contribute to an institution’s ability to discount tuition in a manner that will encourage enrollment decisions of those students who cannot afford or are unwilling to pay the full tuition. Breneman (1994) encourages institutions to analyze the net revenue per student when making aid-related decisions. Empirical research shows that institutional financial factors contribute to explaining Net Tuition Revenue. Hillman’s (2012) study of public four-year colleges and universities found that the following institutional financial factors contributed to explaining Net Tuition Revenue per FTE: lagged net tuition revenue per FTE, in-state tuition sticker price, funded discount rate, unfunded discount rate, and state appropriations.

Unfunded tuition discount rate. Hillman (2012) analyzed the data from the Delta Cost Project for public four-year colleges and universities from 2002 to 2008. The panel dataset included 174 institutions for 7 years. Net tuition revenue per FTE student was used as the outcome variable. The predictor variables were resident and non-resident sticker prices, resident and non-resident enrollments, and funded and unfunded discount rates. Funded and unfunded discount rates were added linearly and quadratically into the model to account for the possible effect of diminishing returns. Two models were used. The first only included the economic variables listed above. The second model included the economic variables in the first model and unique institutional characteristics, such as percent of racial/ethnic minorities, median SAT score, institutional selectivity, and the degree of state subsidization. The analysis implemented a General Method of Moments (GMM) technique.

The results from Hillman's (2012) study show that unfunded institutional aid can be used to generate net tuition revenue. Both Models 1 and 2 empirically support the scholarly literature that unfunded institutional aid can be used for revenue generation, with Model 1 showing that with a percent increase in unfunded institutional aid, an institution gains \$13.21 per FTE in net tuition revenue, and Model 2 shows a gain of \$14.40 per FTE in net tuition revenue. The negative value for the squared discount rates shows that the relationship between discount rates and net tuition revenue is hill-shaped, signifying that there is a point after which net tuition revenue flattens and declines. The marginal financial benefit in net tuition revenue begins to flatten and decline at 9% in Model 1, and 12.7% in Model 2. This finding shows that unfunded institutional aid can be used as an effective revenue management tool until a certain point, after which this practice will have negative financial implications.

Redd (2000) used NACUBO data from 1990-1991 to 1996-1997 to study tuition discount rates and their relation to net tuition revenue at four-year private colleges and universities. He divided the sample of 260 institutions into three groups: highly selective (acceptance rate \leq 30%), selective (acceptance rate $>$ 30% and \leq 60%), and less than selective (acceptance rate $>$ 60%). He used descriptive statistics to analyze the relationship between tuition discount rate changes from 1990-1991 to 1996-1997 and the net tuition revenue per FTE gained over that period. The results show that institutions that had a tuition discount rate increase of 2.5% or less gained the most net tuition revenue per FTE (\$2,844), followed by institutions with tuition discount rate increases of greater than 2.5% but less than 13.1% with a gain of \$1,347. Institutions with tuition discount rates above 13.1% had a decrease of \$301 in net tuition revenue per FTE. For highly selective and selective institutions, with a tuition discount rate increase of 2.1% or less the net tuition revenue per FTE gain was \$4,181; for tuition discount rate increases of over 2.1% to less than 10.9% the net tuition revenue per FTE gain was \$1,431. However, highly selective and selective institutions with tuition discount rate changes of over 10.9% lost \$833 in net tuition revenue per FTE. These results show that tuition discounting can be used to generate net tuition revenue, but there is a peak after which it would hurt the financial health of an institution.

Funded institutional aid. Summers (2004) studied the effect of institutional aid on net tuition revenue at private liberal arts colleges from 1996-1997 to 1999-2000. Data for all baccalaureate I schools based on the 1994 Carnegie Classification system were extracted from the IPEDS. These schools were defined as “more selective” with a focus on undergraduate education and granting over 40% of degrees in liberal arts.

The model in Summers' (2004) study was represented by two simultaneous equations, with institutional aid as the dependent variable in one equation, and FTE as the dependent variable in the other. In the first equation, with institutional aid as the dependent variable, the independent variables were tuition and required fees, FTE, previous year's acceptance rate, previous year's diversity, percentage of students in the top 10% of their high school class the previous year, and the school's total return from its investments. In the second equation with FTE as the dependent variable, the independent variables were tuition and required fees, institutional aid, average tuition and required fees at other schools, US personal income, and total instructional expenditures previous year. Net tuition revenue was derived from the two equations using the formula: $\text{Net Tuition Revenue} = \text{Tuition} * \text{Enrollment} - \text{Aid}$

The findings in Summers' (2004) study provide evidence that institutional aid is positively related to net tuition revenue. Institutional aid is positively related to the previous year's acceptance rate, which indicates that less selective institutions need to provide more aid to achieve enrollment goals.

Revenue from endowment earnings. Highly endowed institutions use their investment income for part of their institutional aid expenditures. An analysis of Delta Cost Project data shows that Doctoral institutions had the largest investment income, compared to Master's and Bachelor's institutions (Desrochers & Hurlburt, 2016). The NACUBO (2017) tuition discounting study showed that Research institutions provided 21.8% of institutional aid in 2016-2017 using endowment funds, compared to only 5% by Comprehensive institutions, and 10.6% by Small institutions. This trend has persisted since 2013-2014 (Table 2).

Table 2

Percentage of Total Undergraduate Institutional Aid funded by Endowment Funds (NACUBO 2017)

	2013-14	2014-15	2015-16	2016-17
Comprehensive	4.20%	6.00%	4.50%	5.00%
Research	24.30%	25.00%	27.90%	21.80%
Small Institutions	10.60%	10.60%	12.00%	10.60%
All Institutions	10.80%	11.30%	12.40%	10.70%

Tuition and fees for full-time undergraduates (sticker price). Institutions set their tuition and fee rates based on institutional missions and strategies. Institutions typically use either a high tuition and high aid model or a low tuition and low aid model (Curs & Singell, 2010). The high tuition and high aid model is effective when an institution is in high demand and there is a sufficient number of students who would pay the high tuition. The excess tuition revenue would then be used to fund needy students and talented students. This is referred to as the “Robin Hood effect,” since it overcharges regular students to fund needy and desired students (Paulsen, 2001). The low tuition and low aid model distributes subsidies to all students and offers little aid. Hillman’s (2012) study found that in-state ($\beta=0.395$, $p<.001$), and out-of-state sticker price ($\beta=0.025$, $p<.05$) were significant factors in relation to net tuition revenue.

Expenditures for instruction, academic support, and student services. The primary expenditure categories of institutions are instruction, research, public service, student services, academic support, institutional support, scholarships and fellowships, plant operations, and auxiliary enterprises (Desrochers & Hurlburt, 2016). Of these, instructional support is the largest expenditure for all categories of institutions. Effective use of instruction, academic support, and student services expenditures helps in the institution’s mission of teaching and learning (Powell, Gilleland, & Pearson, 2012). However, institutions can also be spending lavishly on student spaces to attract new students (Bienen, 2012).

Weaknesses of Prior Research

Hillman (2012) treats all public four-year colleges and universities alike. Public four-year colleges that only offer baccalaureate degrees would be very different than those offering doctorates. Doctoral institutions have the advantage of employing graduate teaching assistants to teach undergraduate classes for a lower cost than full-time tenured professors (Martin, 2002). Doctoral institutions have additional revenue streams with research funding and more endowment assets. The first-time full-time undergraduate grant aid varies by Carnegie classification in public four-year institutions; for example, in 2014-2015, Doctoral institutions provided \$3,490, whereas Master's institutions provided \$1,830, and Bachelor's institutions provided \$1,310. Due to these and other variations, Hillman's findings cannot be generalized to all public four-year institutions. Hillman in his limitations section does indicate that there may be variations by Carnegie classification.

Summers' (2004) study indicates that there is a linear relationship between institutional aid and net tuition revenue. This study does not indicate that there is an upper limit on the tuition discount rate in its positive relationship with net tuition revenue. This is contrary to the findings of Hillman (2012), Massa and Parker (2007), and Redd (2000).

Behaunek (2015) studied how institutional aid at private Bachelor's institutions impacted net tuition revenue using Breneman's (1994) conceptual framework. Behaunek used data from IPEDS and The Institute for College Access and Success (TICAS) from years 2003-2004 to 2012-2013. A dynamic panel dataset was used with a GMM analysis. Following a missing data analysis, 448 institutions were included in the study. The dependent variable was net tuition revenue, and the independent variables were based on economic measures and institutional characteristics. The variables for economic measures were undergraduate tuition and fee levels,

graduate tuition and fee levels, unrestricted and restricted institutional aid amounts, and endowment value per FTE. The variables for institutional characteristics were FTE enrollment, graduate student enrollment, selectivity of admissions, percentage of students identified as racial minority, SAT/ACT of incoming cohort, and number of students receiving Pell Grants.

The findings from the Behaunek (2015) study did not show a positive relationship between the unfunded tuition discount rate and net tuition revenue per FTE for the private Bachelor's schools using the quantitative model in the study. However, this is contrary to the results from descriptive statistics for the year 2012-2013 showed a decrease in net tuition revenue per FTE when the unfunded tuition discount rate exceeded 26.8%. Many of the variables were not statistically significant in explaining net tuition revenue per FTE at 0.05 level. These include graduate tuition and fees, undergraduate FTE, graduate FTE, admitted rate, SAT scores, Pell Grant recipients, and the endowment value.

The findings of the Behaunek (2015) study are contrary to all of the net tuition revenue studies presented. Behaunek indicates that the sample had a wide variation of institutions with different missions, strategies, and student populations. He also indicates that the large number of graduate students in the institutions studied may have had an impact on the results.

This study will correct the flaws in prior research, by studying the relationship of net tuition revenue and the factors affecting it, by Carnegie classification. The Delta Cost Project analysis by Desrochers and Hurlburt (2016) clearly shows that there are variations in net tuition revenue, and in revenue and expense categories by Carnegie classification. The relationship is further highlighted by the variation of net tuition revenue by NACUBO constituent groups (NACUBO, 2017).

This study will focus on private not-for-profit institutions since these institutions rely on tuition revenue for a major portion of their budget, compared to public institutions (NACUBO, 2017; Desrochers & Hurlburt, 2016). There have been no quantitative studies that investigating the relationship between net tuition revenue and institutional aid by Carnegie classification, even though there is clear evidence that the relationship varies by these groups. This study serves to fill the void.

Summary of the Literature Review

Conceptual Framework

Based on the literature, theories, and empirical studies, the conceptual framework in Figure 2 will be used to guide this study. Net tuition revenue will be used as the dependent variable. I will use institutional characteristics and institutional financial factors as independent variables. Within the category of institution characteristics, I will use test scores and percentage of admitted students as measures for selectivity. Percentage of Pell Grants and the percentage of international students will be used for student demographics. The Carnegie classification will be used to group similar institutions.

Institutional financial factors will include the unfunded discount rate, discount rate, endowment income, sticker price, and funded aid. The factors for institutional expenditures will include instruction, academic support, and student services.

Institutional selectivity (%admitted for first-time degree, SAT Math and Verbal combined 75th percentile score). This is based on the resource dependence theory, where institutions seek to maximize their student profile by using their available financial resources. Institutions with more financial resources can use this to enhance their academic profile, prestige, and quality. A higher academic profile improves institutional rankings and attracts

more affluent students, who will be willing to pay more to attend these institutions (Hillman, 2010; Archibald & Feldman, 2008; Pusser & Marginson, 2013). Admit rate has an inverse relationship to test scores. For example, as the percentage of admitted students rises, the composite SAT scores decreases (Hurwitz, 2012). More selective institutions also tend to have higher endowment income per student. For instance, in 2013-2014, for those private nonprofit four-year institutions that admit less than 25% of the applicants, the annual endowment income per student was approximately \$18,000, in contrast to \$850 per student for those institutions that admit over 75% of the applicants (Baum, Johnson, & Lee, 2018).

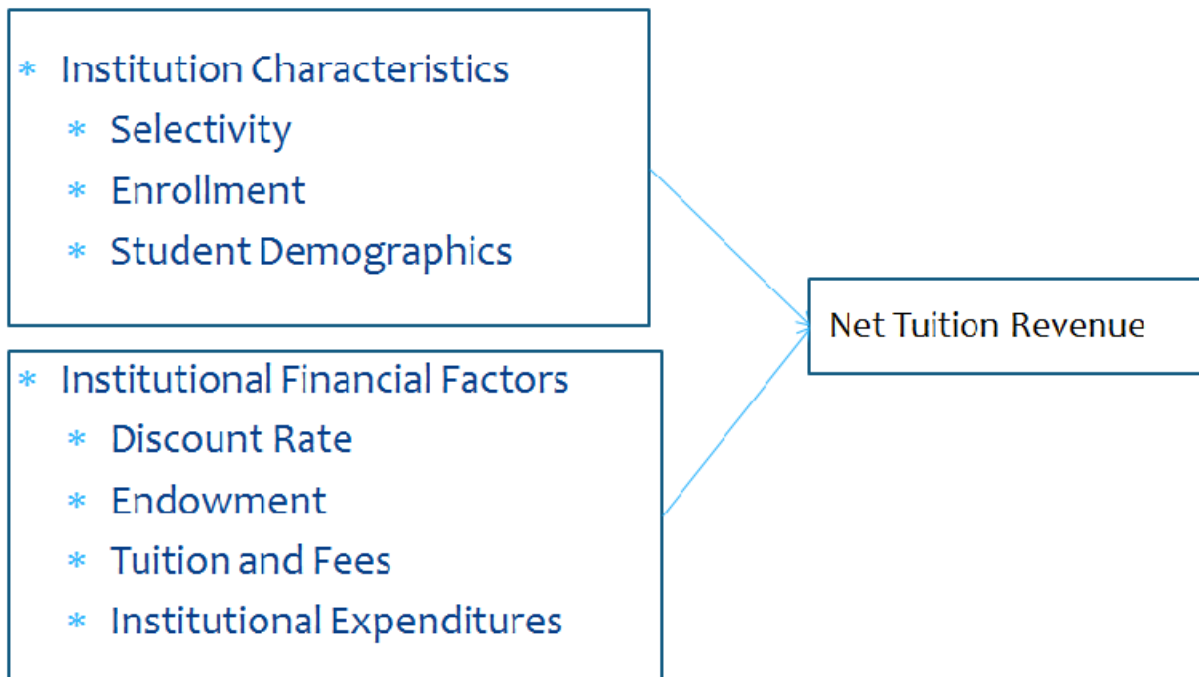


Figure 2. Conceptual diagram. Adapted from multiple sources.

Undergraduate versus graduate enrollment (undergraduate credit hours, graduate credit hours). Since this study includes all private nonprofit institutions from Bachelor’s to Doctoral, expenses and revenue vary by the number of undergraduate and graduate students. On average, expenditures for graduate students are higher compared to those for undergraduate

students (College Board, 2017a). Graduate students also serve as teaching and research assistants at Master's and Doctoral institutions, providing a source of labor.

Student demographics (%Pell, %non-resident international student enrollment).

Institutions use merit-based aid and need-based aid to attract students. The percentage of Pell Grants in relation to the overall student grants will indicate institutional priorities, especially with respect to admitting need-based students. Many institutions are also admitting international students to increase their tuition revenue, since these students get very little aid and are primarily full-pay students. In 2013-2014, for example, 65% of international students were self-financed (Cantwell, 2015).

Carnegie Classification. NACUBO tuition discounting studies have consistently shown that net tuition revenue varies by their constituent groups, such as Small, Comprehensive, and Research institutions as discussed in chapter 2. The Carnegie classification is a standard framework that is widely used to study higher education institutions and to control for institutional differences ("The Carnegie Classification," n.d.). This classification categorizes higher education institutions based on degree-granting patterns. The 2010 Carnegie Classification is the most recent in the Delta Cost Project dataset and is based on degree-granting activities in fall 2008 and spring 2009. *Trends in College Pricing* (College Board, 2017a) shows that net tuition revenue does vary by Carnegie classification, with private nonprofit Doctoral institutions earning \$23,540 per FTE student in 2014-2015, compared to \$15,360 for Master's, and \$15,910 for Bachelor's institutions in that year.

Unfunded tuition discount rate. This is the primary focus of this study. Prior research has shown that increasing the unfunded tuition discount rate can be effective in increasing net tuition revenue, but that there is an upper limit (Summers, 2004; Hillman, 2012). However, there

is an opportunity cost associated with this, since these funds could have been used for other institutional priorities. In 2014, even though institutions diverted institutional funds towards financial aid, 18% of the private nonprofit institutions were projected to have a decline in net tuition revenue, partly due to the tuition discounts (Alstete, 2014).

Funded tuition discount rate and funded institutional aid. Prior research has shown that funded institutional aid and funded tuition discount rate can be effective in increasing net tuition revenue (Hillman, 2012). These funds are restricted for financial aid purposes and are the ideal source for institutional aid with no negative impact on the institutional budget. However, these funds are very limited for many private institutions. In 2016-2017, based on the NACUBO (2017) tuition discount study, Research institutions funded 21.8% of their institutional aid using endowment funds, compared to 10.6% for small institutions and 5% for Comprehensive/Doctoral institutions.

Revenue from endowment earnings. Private educational institutions primarily rely on endowment earnings for additional funds for expenditures, including institutional aid. However, endowment resources vary widely, with some institutions having large reserves while others have insignificant resources. In 2014-2015, 13 private nonprofit four-year institutions had endowment assets of \$1 million or more per student (College Board, 2017a). Revenue from endowment earnings will be used to make decisions on the next year's budget priorities; therefore, I used the previous year's revenue from endowment earnings.

Tuition and fees for full-time undergraduates (sticker price). Institutions use several strategies to set sticker price. Some set a higher tuition rate but also increase financial aid to cover the costs for those who are either unwilling or unable to pay the higher costs. With a higher sticker price, institutions will gain more from full-pay students but this can also have a

“sticker shock” effect for those who do not understand that most students do not pay the sticker price (Haveman & Smeeding, 2006). The goal of this high price/high aid strategy is to gain net tuition revenue and “craft a class” based on institutional priorities (Altringer & Summers, 2015).

Expenditures for instruction, academic support, and student services. Higher expenditures on instruction, academic support, and student services may improve student satisfaction due to the positive effect on academic and social integration. This may help recruit and retain more students, providing the institution with more tuition and fees revenue. Using instructional, academic, and student services resources efficiently also helps to effectively support teaching and learning (Powell, Gilleland, & Pearson, 2012). However, some institutions are also investing in attractive student spaces, such as climbing walls, to attract students (Bienen, 2012). The effect of expenditures for instruction, academic support, and student services will be seen in the next year’s recruitment and retention numbers. Therefore, I used the previous year’s expenditures for instruction, academic support, and student services.

CHAPTER 3

RESEARCH DESIGN

Overview of the Study

The purpose of this study is to investigate the relationship between unfunded institutional aid and net tuition revenue, and how the relationship may differ by Carnegie classification. I also studied other factors that contribute to net tuition revenue. Following the literature review of applicable theories and studies completed on this subject, I used Delta Cost Project data to study this relationship in private, not-for-profit four-year institutions. This chapter will discuss the research questions, research model, hypotheses, data source, and sample used in the study; the dependent and independent variables used for the analysis; the methodology used to study each of the research questions; and the limitations of this study.

Research Questions

The following research questions were addressed:

1. How does unfunded institutional aid relate to net tuition revenue for private nonprofit four-year institutions?
2. Does the relationship vary by Carnegie classification? If so, how?
3. What other factors contribute to net tuition revenue?

Research Model

The research model used to guide this study is shown in Figure 2. The model is based on the resource dependency theory and Breneman's microeconomic theory of the private educational institution as discussed in Chapter 2. This model also incorporates reviews of prior studies, while incorporating information to reduce the deficiencies seen in prior models. The outcome variable of the model is net tuition and fees revenue. The model includes institutional characteristics and financial factors. Institutions set budget priorities months before the

beginning of the fiscal year, and they use some information from the current year with projected enrollment targets. There are also instances where information from the previous year is used to set budget priorities for the current year, such as investment income. Expenditures from the previous year, such as academic support, instruction, and student services, have an impact on enrollment numbers the following year. Therefore, some of the factors will depend on the previous year's data, and I used lagged data in such cases (Hillman, 2012; Behaunek, 2015). I note this when discussing each of the research variables later in this chapter.

Hypotheses

The research questions were studied using the following two hypotheses.

Hypothesis I: The amount of unfunded institutional aid given to students is associated with the net tuition revenue earned by the institution. The rationale for this hypothesis is that institutions primarily use unfunded institutional aid to impact enrollment decisions. Students are more likely to enroll at an institution if the institutional aid provided is sufficient to tilt their decision in favor of enrollment, thereby giving the institution some amount of tuition and fee dollars.

Hypothesis II: The association of unfunded institutional aid with net tuition revenue varies by Carnegie classification. The rationale for this hypothesis is that the NACUBO (2017) study showed that net tuition revenue varied by NACUBO constituent groups: Research, Comprehensive, and Small institutions, with Research institutions having the largest gain over the previous year, and Small institutions having the least gain, while the discount rate was higher for small institutions compared to the others. This trend was also shown in the College Board's *Trends in College Pricing* (2017a) report. Based on this, I would expect the impact of institutional aid on net tuition revenue would vary by Carnegie classification.

Data Source and Sample

The Delta Cost Project database, which is derived from the IPEDS database, was used as the data source for this study. IPEDS surveys are administered by the United States Department of Education's National Center for Educational Statistics. These surveys are completed by every college and university that participates in the federal financial aid system. This is mandatory for all schools participating in the federal financial aid programs and is stipulated in the Higher Education Act of 1965 as amended (IPEDS, n.d.). The focus of the Delta Cost Project is to promote the study of trends in postsecondary education with an emphasis on revenue and expenditures. The Delta Cost Project database contains data from 1986-1987 to 2014-2015 and organizes the data in multiple longitudinal dataset formats ("The Delta Cost Project," 2015).

The study selected private nonprofit institutions from 2006 to 2015 based on the Carnegie Classification 2010. The Carnegie Classification 2010 was used since the latest classification in the dataset was 2010.

The Delta Cost Project public release data file 2000-2015 was used to create the final panel data file for analysis. Since the focus of this study is private nonprofit four-year and above institutions from years 2006 to 2015, the data file for analysis retained only those institutions which are listed as sector 2 and those in the Carnegie 2010 classifications listed in Table 3. Carnegie 2010 classifications of 15, 16, and 17 were grouped as Doctoral; those in classifications 18, 19, and 20 were grouped as Master's; and those in 21 and 22 were classified as Bachelor's institutions. These deletions resulted in a data file of 959 institutions, with 9,449 observations. The breakdown of the observations, by Doctoral, Master's, and Bachelor's groups, were 1,060, 3,604, and 4,785, respectively.

Table 3

Carnegie 2010 Classifications Used in the Study

Carnegie 2010 Classification	Description
15	Research Universities (very high research activity)
16	Research Universities (high research activity)
17	Doctoral/Research Universities
18	Master's Colleges and Universities (larger programs)
19	Master's Colleges and Universities (medium programs)
20	Master's Colleges and Universities (smaller programs)
21	Baccalaureate Colleges—Arts & Sciences
22	Baccalaureate Colleges—Diverse Fields

Note: Adapted from *The Carnegie Classification of Institutions of Higher Education*, n.d., retrieved from <http://carnegieclassifications.iu.edu/>.

Missing data analysis was conducted on the data file. The results of the analysis are shown in Table 4.

Table 4

Missing Data Analysis

Variable	Missing	Total	Percent Missing
Log Net Tuition Revenue	59	9,449	0.62
Unfunded Discount Rate	1,426	9,449	15.09
Discount Rate	1,426	9,449	15.09
SAT 75 th Percentile Equivalent	2,686	9,449	28.43
Log Undergrad Credit Hours	116	9,449	1.23
Log Graduate Credit Hours	2,147	9,449	22.72
Percentage of Pell Grants	289	9,449	3.06
Percentage International Students	26	9,449	0.28
Log Investment Income	818	9,449	8.66
Log Tuition (Sticker Price)	126	9,449	1.33
Log Funded Aid	770	9,449	8.15
Log Instruction Expenditures	64	9,449	0.68
Log Student Services Expenditures	72	9,449	0.76
Log of Academic Support Expenditures	99	9,449	1.05
Percentage Admitted	833	9,449	8.82

The largest percentage of missing data was the test scores, which had 28.4% missing. This is due to several schools having a test scores optional admission policy and some who did not

submit test scores in some years. I interpolated test scores for those institutions that did not submit test scores in some years. Graduate credit hours had the next largest missing data percentage, but this is due to Bachelor's schools with no graduate programs and some not submitting data in some years. For Bachelor's schools with no graduate programs, I assigned zero for graduate credit hours. Unfunded discount rate and the overall discount rate had approximately 15% missing data. This was due to data not being submitted in some years and some institutions that do not provide institutional aid. Investment income, funded institutional aid, and percentage admitted had approximately 8% missing data.

Further analysis of the data file identified 24 institutions that had closed or moved from nonprofit to for-profit status since 2006. These institutions were deleted from the data file. Two institutions were missing one year of data, three institutions were missing two years of data, and four were missing four years of data. The missing years for these institutions were interpolated from adjacent years. Since the study focuses on net tuition revenue and its relationship to unfunded discount rate, institutions whose mission is to serve adult learners do not fit into the purpose of the study. Nine institutions that were primarily serving adult learners and did not have any first-time full-time first-year degree seeking students were deleted from the data file.

The resulting panel data file contained missing values for some variables, and interpolation was used to interpolate the missing values as was done in prior research for panel data (Chen, 2012, Zhang & Ness, 2010). Interpolation was used for independent variables in panel data analysis when the numbers of missing values were small (Zhang & Ness, 2010). Interpolation was used to impute independent variables only. The missing values for the dependent variable, Net Tuition Revenue, was not imputed. Six institutions with negative or missing net tuition revenue were deleted from the data file. Interpolation does not help if no data

are available for all years. Following the interpolation, 27 institutions did not have any data for the percentage admitted variable, which is a critical variable for institutional selectivity in the model. Therefore, these institutions were deleted from the data file. The test scores variable had missing data for 95 institutions. Analysis was done with and without the test scores variable in the model. The results showed that the test scores variable was not a significant predictor in the model and did not impact the variance explained by the model. The test scores variable was removed from the model, but the institutions were retained in the data file. In the final step, all the financial variables, including net tuition revenue, were adjusted for inflation by dividing their values by the `cpi_scalar_2015` value in the Delta Cost Project data file, to transform them to constant 2015 dollars. All the financial variables were logged prior to analysis to enable interpretation of the effects of the variables as percentage changes. Log transformations also help to attenuate any skewness in the variable distributions, and possible outliers. The final study sample contained 100 Doctoral, 340 Master's, and 432 Bachelor's institutions.

Research Variables

Dependent Variable

The dependent variable was net tuition revenue, a continuous variable measured by the gross tuition and fees revenue minus institutional grant aid.

Independent Variables

Institutional characteristics. Institutional characteristics were studied using the variables, percentage admitted for first-time degree, SAT math and verbal combined 75th percentile score, undergraduate credit hours, graduate credit hours, Pell Grant percentage, international student enrollment percentage, and 2010 Carnegie classification.

The percentage admitted for first-time degree is a continuous variable and was calculated as the percentage of the ratio of the total number of students admitted to total number of applicants.

The SAT Math and Verbal combined 75th Percentile score was created using both SAT and ACT equivalent scores. The ACT and SAT concordance table was used to convert the ACT scores to equivalent SAT scores. Given the following variables: SAT Math 75th percentile score as *satmt75*, SAT Critical Reading 75th percentile score as *satvr75*, the number of first-time degree-seeking students submitting SAT scores as *satnum*, ACT Composite 75th percentile score as *actcm75*, and the number of first-time degree seeking students submitting ACT scores as *actnum*; the following formula was used to get the final score:

$$SAT75 = \frac{satnum (satmt75+satvr75)}{satnum+actnum} + \frac{actnum (SAT equiv of actcm75 from Concordance table)}{satnum+actnum}$$

Undergraduate Credit Hours, the instruction hours based on credit for undergraduates, is a continuous variable. The log of undergraduate credit hours was used in the model.

Graduate Credit Hours, the instruction hours based on credit for graduates, is a continuous variable. The log of graduate credit hours was used in the model.

Pell Grant Percentage, the percentage of Pell Grants disbursed compared to total student grant aid which includes Pell, Federal, State, Local, and Institutional grants, is a continuous variable.

Non-resident international student enrollment percentage, the percentage of non-resident international students compared to the total enrollment, is a continuous variable. Non-resident international student enrollment represents students who are not citizens or nationals of the United States and are in the country on a visa or temporary basis.

2010 Carnegie Classification was coded as a categorical variable. Bachelor's institutions were coded as a 1, Master's institutions were coded as a 2, and Doctoral institutions were coded as a 3.

Institutional financial factors. Institutional financial factors included the unfunded tuition discount rate, overall discount rate, revenue from investment earnings and gifts, tuition and fees for full-time undergraduates, funded institutional aid, expenditures for instruction, expenditures for student services, and expenditures for academic support services.

Unfunded tuition discount rate, the unfunded institutional aid divided by the gross tuition and fees revenue, expressed as a percentage, is a continuous variable. In addition to the unfunded tuition discount rate, the square of this variable was also included to identify turning points in the relationship to net tuition revenue (Hillman, 2012).

Overall tuition discount rate, the total institutional aid divided by the gross tuition and fees revenue, expressed as a percentage, is a continuous variable. In addition to the overall tuition discount rate, the square of this variable was also included to identify turning points in the relationship to net tuition revenue (Hillman, 2012).

The Revenue from investment earnings and gifts is a continuous variable. I used the previous year's information.

The Tuition and Fees for full-time undergraduates (sticker price) is a continuous variable. Funded institutional aid is a continuous variable.

Expenditures for instruction, student services, and academic support services are continuous variables. I used the previous year's information for these variables.

The variables used in the study were generated using data fields in the Delta Cost Project data file. Table 5 shows the variables, the codes, and the calculations used.

Table 5

Dependent and Independent Variables Used in the Model with Delta Cost Project Data Fields Used in the Calculation.

Variable	Calculation
Log Net Tuition Revenue (Log_NTR1)	$\log(\text{nettuition01})$
Unfunded Discount Rate (UDR)	$(\text{grant06} / (\text{NTR} + \text{grant05} + \text{grant06})) * 100$
Unfunded Discount Rate Squared (UDR2)	$\text{UDR} * \text{UDR}$
Discount Rate (DR)	$((\text{grant05} + \text{grant06}) / (\text{NTR} + \text{grant05} + \text{grant06})) * 100$
Discount Rate Squared (DR2)	$\text{DR} * \text{DR}$
Log Undergrad Credit Hours (Log_UGCR)	$\log(\text{credhoursug})$
Log Graduate Credit Hours (Log_GRGR)	$\log(\text{credhoursgr})$
Percentage of Pell Grants (PELL_PCT)	$(\text{grant01} / \text{grant07}) * 100$
Percentage International Students (PCT_NR)	$(\text{total_enrollment_nonres_tot} / \text{total_enrollment}) * 100$
Previous Year Log Investment Income (L.Log_INV1)	$\log(\text{priv_invest_endow})$
Log Tuition (Log_TUI1)	$\log(\text{tuitionfee02_tf})$
Log Funded Aid (Log_FUND1)	$\log(\text{grant05})$
Previous Year Log Instruction Expenditures (L.Log_INSTR1)	$\log(\text{instruction01_fasb})$
Previous Year Log Student Services Expenditures (L.Log_STUSERV1)	$\log(\text{studserv01_fasb})$
Previous Year Log of Academic Support Expenditures (L.Log_ACAD1)	$\log(\text{acadsupp01_fasb})$
Percentage Admitted (PAD)	$(\text{admitcount} / \text{applicantcount}) * 100$

Note: Codes used in parentheses.

Analysis Method

Panel data analysis was conducted to study the research questions. The final dataset was a balanced panel with all the variables in this study. Panel data analysis provides the capability to analyze the variation within each institution and between institutions, over a period of several years. I used ten years of data from 2006 to 2015 for this analysis. The use of panel data

analysis helps to solve the omitted variable bias seen in regression models. Panel data analysis controls for omitted variables between institutions that are constant over time, as well as those that vary over time but are constant between institutions. The fixed effect estimator uses the within variation over time, and the random effects estimator uses a weighted average of the between and within estimates (Wooldridge, 2003; Katchova, 2013). It is important to use the correct estimator, since the fixed effect model, even though it will always provide consistent estimates, will not be the most efficient model if the appropriate model is the random effects. Similarly, the random effects estimator will be inconsistent if the appropriate model is the fixed effects model. Typically, a Hausman test is run to determine the best model to be used. If the Hausman test is significant, then the fixed effects model should be used; otherwise, the random effects model is more appropriate (Katchova, 2013). Therefore, the fixed effects and random effects estimators were run, and the Hausman test was used to determine the appropriate estimator in each case. In this study, the Hausman test was significant for all analyses, making fixed effects the appropriate model in all cases.

Analysis for Research Question 1

The following model was run for all institutions for all the years. This model looked at unfunded discount rate and its relationship to net tuition revenue, controlling for institutional characteristics and financial factors.

$$\begin{aligned}
 NTR_{it} = & \alpha_i + \beta_{UDR}UDR_{it} + \beta_{UDR2}UDR2_{it} + \beta_{DR}DR_{it} + \beta_{DR2}DR2_{it} + \beta_{PAD}PAD_{it} \\
 & + \beta_{UGCR}UGCR_{it} + \beta_{GRCR}GRCR_{it} + \beta_{PELL}PELL_{it} + \beta_{NR}NR_{it} + \beta_{INV}INV_{it-1} \\
 & + \beta_{TUI}TUI_{it} + \beta_{FUND}FUND_{it} + \beta_{INSTR}INSTR_{it-1} + \beta_{ACAD}ACAD_{it-1} \\
 & + \beta_{STUSERV}STUSERV_{it-1} + i.\beta_{Year}Year_t + u_{it}
 \end{aligned}$$

where

$NTR = \text{Log of Net Tuition Revenue for institution } i \text{ in year } t$
 $\alpha_i = \text{the intercept}$
 $\beta_{UDR} = \beta \text{ for Unfunded Discount Rate}$
 $UDR_{it} = \text{The Unfunded Discount Rate for institution } i \text{ in year } t$
 $\beta_{UDR2} = \beta \text{ for Square of Unfunded Discount Rate}$
 $UDR2_{it} = \text{The Square of Unfunded Discount Rate for institution } i \text{ in year } t$
 $\beta_{DR} = \beta \text{ for Discount Rate}$
 $DR_{it} = \text{The Discount Rate for institution } i \text{ in year } t$
 $\beta_{DR2} = \beta \text{ for Square of Discount Rate}$
 $DR2_{it} = \text{The Square of Discount Rate for institution } i \text{ in year } t$
 $\beta_{PAD} = \beta \text{ for Percentage Admitted}$
 $PAD_{it} = \text{The Percentage Admitted for institution } i \text{ in year } t$
 $\beta_{UGCR} = \beta \text{ for Undergraduate Credit Hours}$
 $UGCR_{it} = \text{The log of Undergraduate Credit Hours for institution } i \text{ in year } t$
 $\beta_{GRCR} = \beta \text{ for Graduate Credit Hours}$
 $GRCR_{it} = \text{The log of Graduate Credit Hours for institution } i \text{ in year } t$
 $\beta_{PELL} = \beta \text{ for Percentage of PELL}$
 $PELL_{it} = \text{The Percentage of PELL for institution } i \text{ in year } t$
 $\beta_{NR} = \beta \text{ for Percentage of international students}$
 $NR_{it} = \text{The Percentage of international students for institution } i \text{ in year } t$
 $\beta_{INV} = \beta \text{ for Investment Income}$
 $INV_{it-1} = \text{The log of Investment Income for institution } i \text{ in year } t-1$
 $\beta_{TUI} = \beta \text{ for Sticker Price}$
 $TUI_{it} = \text{The log of Sticker Price for institution } i \text{ in year } t$
 $\beta_{FUND} = \beta \text{ for Funded Institutional Aid}$
 $FUND_{it} = \text{The log of Funded Institutional Aid for institution } i \text{ in year } t$
 $\beta_{INSTR} = \beta \text{ for Expenditures for Instruction}$
 $INSTR_{it-1} = \text{The log of Expenditures for Instruction for institution } i \text{ in year } t-1$
 $\beta_{ACAD} = \beta \text{ for Expenditures for Academic Support}$
 $ACAD_{it-1} = \text{The log of Expenditures for Academic Support for institution } i \text{ in year } t-1$
 $\beta_{STUSERV} = \beta \text{ for Expenditures for Student Services}$
 $STUSERV_{it-1} = \text{The log of Expenditures for Student Services for institution } i \text{ in year } t-1$
 $\beta_{Year} = \beta \text{ for Year Fixed Effects}$
 $Year_t = \text{Year Fixed Effects in year } t$
 $u_{it} = \text{Error term}$

Analysis for Research Question 2

Subgroup analysis was conducted to answer question 2, by running the same model above for private nonprofit institutions with different Carnegie sector classifications, namely Bachelor's, Master's, and Doctoral.

Analysis for Research Question 3

The model used in question 1 was used to identify other significant factors that contribute to net tuition revenue. The analysis was done using interaction terms for unfunded discount rate, log of graduate credit hours, percent of international students, and funded institutional aid by Carnegie group. The Bachelor's group was used as the reference group.

Limitations of This Study

This study is based on the IPEDS data surveys. The data collected from these surveys is a standard method used for educational research. The surveys are mandatory for all institutions receiving United States federal financial aid under Title IV. The accuracy of the IPEDS data is dependent on the accuracy of individual institutions' data gathering and data entry. While there are limited data validation checks during the submission process, there is no process for a complete audit of all submissions.

The percentage of missing data for test scores was over 28%, and even after interpolation, the missing data was excessive, with 95 institutions missing test scores. This was due to many schools having a test scores optional policy and not reporting any test scores for all the years. I did the analysis with and without the test scores variable in the model. The test scores variable proved not to be a significant predictor of net tuition revenue and did not impact the variance explained by the model. Therefore, the test scores variable was dropped from the model used in the study.

There were missing data values for all years, with other covariates, for some schools. The percentage admitted variable was missing data for 27 institutions. Since percentage admitted is an important variable to identify selectivity, these institutions were dropped from

analysis. The overall and between variation explained by the model did not change significantly after dropping these institutions.

The period of this study included the recession between 2008 and 2010. During the recession many institutions experienced a decrease in endowment value and returns. The recession led to tuition increases, budget cuts, staff and faculty furloughs, and other financial constraints (Wellman, 2010). This was addressed with the year fixed effects.

CHAPTER 4
RESEARCH FINDINGS

Introduction

The purpose of this study is to analyze the relationship of unfunded institutional aid to net tuition revenue, and how this relationship varies by Carnegie classification in private nonprofit four-year and above institutions. This study also identifies factors that contribute to net tuition revenue. Based on the methodology discussed in Chapter 3, this chapter presents the research findings following the analysis of the panel data file. The discussion is organized by research question. This chapter will begin with descriptive statistics of the data sample, followed by a detailed analysis of the results by research question.

Descriptive Statistics

The final data file for analysis included 872 educational institutions. The descriptive statistics are shown in Table 6. Net Tuition Revenue was used as the dependent variable in the study. The panel dataset was balanced over the ten-year period, 2006 to 2015. The descriptive statistics show that there is a large variance of unfunded discount rate in the final data file which is the primary focus of this study. Large variances are also seen with the discount rate, graduate credit hours, percentage of Pell Grants, and percentage of international students. This is to be expected since the panel records included small schools to large research institutions. The average unfunded discount rate, which is the primary focus of this study, was 27.64% across all institutions. The average total discount rate was 32.66%. The average percentage of Pell Grants was 16%. The average percentage of international students was 4.2%. The average percentage of admitted students was 63.5%.

Table 6

Descriptive statistics for dependent and independent variables for private four-year nonprofit schools used in the dataset

Variable	Observations	Mean	Std. Dev.
Log Net Tuition Revenue	8,720	17.241	1.153
Unfunded Discount Rate	8,720	27.637	13.508
Unfunded Discount Rate Squared	8,720	946.263	813.386
Discount Rate	8,720	32.663	13.763
Discount Rate Squared	8,720	1256.257	978.219
Log Undergrad Credit Hours	8,720	10.870	0.887
Log Graduate Credit Hours	8,720	7.250	3.735
Percentage of Pell Grants	8,720	15.941	17.561
Percentage International Students	8,720	4.206	6.197
Log Investment Income	8,720	16.013	2.071
Log Tuition (Sticker Price)	8,720	10.106	0.441
Log Funded Aid	8,720	13.659	2.850
Log Instruction Expenditures	8,720	16.776	1.234
Log Student Services Expenditures	8,720	15.862	1.018
Log of Academic Support Expenditures	8,720	15.253	1.385
Percentage Admitted	8,720	63.504	18.834

Descriptive statistics based on Carnegie groups show that 432 Bachelor's, 340 Master's, and 100 Doctoral institutions over the 10-year period are included in the final data file (Table 7). The table shows that based on the means between the different Carnegie groups, Bachelor's institutions have the largest unfunded discount rates, but receive the least in net tuition revenue. This is consistent with the NACUBO 2017 discount study discussed in Chapter 2.

Table 7

Descriptive Statistics for Private Bachelor's, Master's, and Doctoral Four-Year Nonprofit Schools Used in the Dataset

Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	<i>Bachelor's</i> (<i>n=4,320</i>)		<i>Master's</i> (<i>n=3,400</i>)		<i>Doctoral</i> (<i>n=1,000</i>)	
Log Net Tuition Revenue	16.625	0.943	17.529	0.791	18.923	0.934
Unfunded Discount Rate	30.798	14.874	24.813	11.580	23.586	9.646
Unfunded Discount Rate Squared	1169.696	979.334	749.737	539.373	649.225	449.743
Discount Rate	37.258	14.465	27.656	11.127	29.833	11.944
Discount Rate Squared	1597.382	1127.150	888.625	589.341	1032.547	814.875
Log Undergrad Credit Hours	10.454	0.732	11.073	0.740	11.977	0.756
Log Graduate Credit Hours	4.598	3.603	9.506	0.895	11.035	0.921
Percentage of Pell Grants	16.190	17.677	17.612	17.988	9.187	13.573
Percentage International Students	3.499	4.069	3.419	6.888	9.939	8.064
Log Investment Income	15.869	1.712	15.586	2.110	18.088	2.142
Log Tuition (Sticker Price)	10.085	0.451	10.062	0.400	10.349	0.459
Log Funded Aid	13.421	2.938	13.332	2.711	15.801	1.840
Log Instruction Expenditures	16.225	0.950	16.886	0.846	18.779	1.265
Log Student Services Expenditures	15.483	0.905	15.959	0.804	17.168	0.969
Log of Academic Support Expenditures	14.684	1.133	15.358	1.008	17.358	1.364
Percentage Admitted	62.742	18.585	68.431	15.096	50.045	23.680

The average unfunded discount rate is 30.8% for Bachelor’s institutions, 24.8% for Master’s institutions, and 23.6% for Doctoral institutions. The average total discount rate was highest at 37.3% at Bachelor’s institutions, followed by 29.8% at Doctoral, and 27.7% at Master’s institutions. The largest amount of funded aid is given by Doctoral institutions, as is consistent with NACUBO studies.

There is not much variation between sticker price between the groups. Doctoral institutions have the highest number of international students. This is to be expected since Doctoral institutions are larger and employ international students for graduate teaching and research assistantships and fellowships. International students serve as a source of teaching staff for undergraduate courses. The data also show that Doctoral institutions gain the highest amount of investment income. Doctoral institutions have the lowest admit rate of first-time full-time degree-seeking students but offer the highest number of undergraduate credit hours. The highest average admit rate of 68.4% was at Master’s institutions, followed by 62.7% for Bachelor’s, and 50% at Doctoral institutions. This shows that Doctoral institutions are the most selective of the institutions in the data file. Table 8 shows the unfunded discount rate by percentile in 2015 in the study dataset.

Table 8

2015 Unfunded Discount Rate by Percentile and Carnegie Group in the Study Dataset

Unfunded Discount Rate	25 th Percentile	50 th Percentile	75 th Percentile	90 th Percentile
Overall	23.9	32.86	41.27	47.73
Bachelor’s	26.3	37.76	45.66	52.34
Master’s	22.28	30.67	37.25	42.11
Doctoral	22.57	27.67	32.73	37.34

The data show that 25% of Bachelor’s institutions have unfunded discount rates over 45%, and 10% of Master’s institutions have unfunded discount rates over 42%.

Research Question 1

How does unfunded institutional aid relate to net tuition revenue for private nonprofit four-year and above institutions?

The fixed effects model (Table 9) shows that the model explains 96% of the overall variance in log Net Tuition Revenue. The model shows that the unfunded discount rate is a significant predictor of net tuition revenue ($p < 0.001$). The results show that a 1% increase in unfunded discount rate is associated with a 0.5% increase in net tuition revenue. The significant coefficient for the quadratic term for the unfunded discount rate ($p < 0.001$) is negative, indicating that the positive impact on net tuition revenue has a turning point. The turning point is given by:

$$\frac{-\beta_{UDR}}{2\beta_{UDR2}} = \frac{-0.0049963}{2 * (-0.0000717)} = 34.84\%$$

The turning point shows that the maximum benefit associated with the unfunded discount rate is at 34.84%, and at any rate over that is associated with a net tuition revenue decline. Table 8 shows that 25% of institutions in the dataset had unfunded discount rates over 41%, and half of all the institutions had discount rates over 33% in 2015. This should be a concern for university administrators.

Table 9

Fixed Effects Analysis of Private Nonprofit Schools in the Dataset

Log Net Tuition Revenue (Log_NTR1)	Fixed Effects
Unfunded Discount Rate (UDR)	0.005 (0.001)***
Unfunded Discount Rate Squared (UDR2)	-0.000 (0.000)***
Log Undergrad Credit Hours (Log_UGCR)	0.460 (0.001)***
Log Graduate Credit Hours (Log_GRCR)	0.024 (0.003)***
Percentage of Pell Grants (PELL_PCT)	-0.000 (0.000)
Percentage International Students (PCT_NR)	0.005 (0.001)***
Previous Year Log Investment Income (L.Log_INV1)	0.001 (0.002)
Log Funded Aid (Log_FUND1)	0.003 (0.002)
Previous Year Log Student Services Expenditures (L.Log_STUSERV1)	0.05 (0.007)***
Previous Year Log Instruction Expenditures (L.Log_INSTR1)	0.143 (0.01)***
Previous Year Log of Academic Support Expenditures (L.Log_ACAD1)	0.008 (0.005)
Log Tuition (Sticker Price) (Log_TUI1)	0.563 (0.024)***
Discount Rate (DR)	-0.007 (0.001)***
Discount Rate Squared (DR2)	-0.000 (0.000)***
Percentage Admitted (PAD)	-0.000 (0.000)
	Academic Year
	2008
	2009
	2010
	2011
	2012
	2013
	2014
	2015
Constant	3.43 (0.286)***
R2-within	0.7
R2-between	0.96
R2-overall	0.96
Rho	0.929

Note: Standard Error in parentheses (n=872)

* p < 0.05, ** p < 0.01, *** p < 0.001

The significant coefficient for the quadratic term for the unfunded discount rate ($p < 0.001$) is negative, indicating that the positive impact on net tuition revenue has a turning point. The turning point is given by:

$$\frac{-\beta_{UDR}}{2\beta_{UDR2}} = \frac{-0.0049963}{2 * (-0.0000717)} = 34.84\%$$

The turning point shows that the maximum benefit associated with the unfunded discount rate is at 34.84%, and at any rate over that is associated with a net tuition revenue decline. Table 8 shows that 25% of institutions in the dataset had unfunded discount rates over 41%, and half of all the institutions had discount rates over 33% in 2015. This should be a concern for university administrators.

Hillman's (2012) study of public four-year colleges and universities showed that an unfunded discount rate over 13% is associated with a decline in net tuition revenue. The lower peak unfunded discount rate at public institutions can be attributed to the lower tuition costs at these institutions, and the average institutional grant award being much smaller compared to that at private nonprofit four-year institutions. For example, in 2015-2016, the average institutional grant award at public four-year institutions was \$4,900, compared to \$16,100 at private nonprofit four-year institutions (Radwin et al., 2018). The corresponding average published full-time undergraduate tuition and fees was \$9,670 at public four-year institutions, compared to \$33,180 at private four-year institutions (College Board, 2017a).

Research Question 2

Does the relationship vary by Carnegie classification? If so, how?

The unfunded discount rate was significant ($p < 0.001$) for Bachelor's institutions, showing that a 1% increase in the unfunded discount rate is associated with 0.7% increase in net tuition revenue (Table 10). The quadratic unfunded discount rate term is significant and negative

indicating a turning point in the relationship. The turning point is given by the following equation:

$$\frac{-\beta_{UDR}}{2\beta_{UDR2}} = \frac{-0.0073453}{2 * (-0.0000943)} = 38.95\%$$

The above equation shows that the positive association of unfunded discount rate with net tuition revenue at Bachelor's institutions has an upper limit of 38.95%, and any rate over that, is associated with a net tuition revenue decline. Table 8 shows that half of the Bachelor's institutions have a discount rate over 38%. University administrators at Bachelor's institutions should review tuition discounting practices to ensure that their discount rates are not negatively impacting institutional revenue.

The unfunded discount rate at Master's institutions was significant ($p < 0.05$), indicating that a 1% increase in unfunded discount rate is associated with a 0.4% increase in net tuition revenue. However, the quadratic term of unfunded discount rate was not significant. The unfunded discount rate relationship to net tuition revenue was weaker in Master's institutions compared Bachelor's institutions, with no conclusive evidence of a turning point. The unfunded discount rate was not significant with Doctoral institutions. This indicates that Master's and Doctoral institutions should look at other factors to increase net tuition revenue, rather than relying on unfunded tuition discounting to generate net tuition revenue. As shown in Table 8, 25% of Master's institutions and 10% of Doctoral institutions have unfunded discount rates over 37%, which may be of concern. These institutions may want to review the appropriateness of their tuition discounting practices. This clearly shows that the unfunded discount rate and its association with net tuition revenue is dependent on the Carnegie groups.

Table 10

Fixed Effects Analyses of Bachelor's, Master's, and Doctoral Private Nonprofit Schools

Log Net Tuition Revenue (Log_NTR1)	Bachelor's	Master's	Doctoral
Unfunded Discount Rate (UDR)	0.007 (0.001)***	0.004 (0.002)*	-0.001(0.001)
Unfunded Discount Rate Squared (UDR2)	-0.000(0.000)***	-0.000 (0.000)	0.000 (0.000)**
Log Undergrad Credit Hours (Log_UGCR)	0.500 (0.014)***	0.37 (0.013)***	0.321 (0.021)***
Log Graduate Credit Hours (Log_GRCR)	0.007 (0.004)	0.068 (0.006)***	0.024 (0.008)**
Percentage of Pell Grants (PELL_PCT)	0.002 (0.001)**	-0.003 (0.000)***	-0.002 (0.001)*
Percentage International Students (PCT_NR)	0.01 (0.001)***	- 0.001 (0.001)	0.006 (0.001)***
Previous Year Log Investment Income (L.Log_INV1)	0.004 (0.003)	-0.000 (0.002)	-0.002 (0.002)
Log Funded Aid (Log_FUND1)	0.008 (0.004)	0.000 (0.003)	-0.007 (0.004)
Previous Year Log Student Services Expenditures (L.Log_STUSERV1)	0.039 (0.011)***	0.071 (0.01)***	0.040 (0.011)***
Previous Year Log Instruction Expenditures (L.Log_INSTR1)	0.090 (0.014)***	0.270 (0.015)***	0.249 (0.019)***
Previous Year Log of Academic Support Expenditures (L.Log_ACAD1)	-0.12 (0.009)	0.045 (0.007)***	-0.006 (0.011)
Log Tuition (Sticker Price) (Log_TUI1)	0.853 (0.041)***	0.287 (0.030)***	0.388 (0.045)***
Discount Rate (DR)	-0.003 (0.001)*	-0.012 (0.002)***	-0.012 (0.002)***
Discount Rate Squared (DR2)	-0.000 (0.000)***	-0.000 (0.000)	-0.000 (0.000)***
Percentage Admitted (PAD)	-0.000 (0.000)*	0.000 (0.000)	-0.001 (0.000)**
Academic Year			
2008	-0.016 (0.007)*	0.011 (0.006)	0.005 (0.007)
2009	0.002 (0.008)	0.047 (0.006)***	0.024 (0.008)**
2010	0.009 (0.009)	0.075 (0.008)***	0.046 (0.010)***
2011	0.019 (0.010)	0.102 (0.009)***	0.069 (0.010)***
2012	0.027 (0.010)**	0.114 (0.009)***	0.081 (0.010)***
2013	0.034 (0.011)**	0.118 (0.010)***	0.078 (0.011)***
2014	0.019 (0.012)	0.117 (0.010)***	0.089 (0.012)***
2015	0.036 (0.012)**	0.134 (0.011)***	0.095 (0.013)***
Constant	1.08 (0.456)*	3.96 (0.386)***	6.13 (0.601)***
R2-within	0.73	0.75	0.81
R2-between	0.93	0.96	0.97
R2-overall	0.92	0.95	0.96
Rho	0.885	0.864	0.981

Note: Standard error in parentheses.

* p < 0.05, ** p < 0.01, *** p < 0.001

Interaction Effects

The model tests carried out earlier assumed that all variations were due to the main effects of the variables. Based on the results so far and on the literature review in Chapter 2, I ran a fixed effects analysis to explore interaction effects of the unfunded discount rate, log of graduate credit hours, percent of international students, and log of funded institutional aid by Carnegie group (Table 11).

The results of the interaction effects show that each 1% increase in the unfunded discount rate is associated with a 0.7% increase in net tuition revenue for Bachelor's institutions ($p < 0.001$), and a 0.5% increase in net tuition revenue for Master's institutions ($p < 0.01$). The interaction effect test ($p < 0.001$) shows that Bachelor's institutions leverage unfunded institutional aid significantly more than other Carnegie groups to gain net tuition revenue. When comparing graduate credit hours, a 1% increase in graduate credit hours is associated with only a 0.01% increase in net tuition revenue for Bachelor's institutions ($p < 0.05$), whereas Master's institutions gain 0.76% ($p < 0.001$). This is expected since Bachelor's institutions have very few graduate students. Master's and Doctoral institutions, in contrast, have a large number of graduate students. When comparing international student enrollment, the interaction terms show that, a 1% increase in international students, is associated with a 1% increase of net tuition revenue for Bachelor's institutions ($p < 0.001$), and a 0.1% reduction in net tuition revenue for Master's institutions ($p < 0.001$). This is somewhat surprising, since I would expect more international students at Master's and Doctoral institutions, and most of them pay the total tuition cost. When analyzing funded institutional aid, even though the Bachelor's and Doctoral interaction terms are significant ($p < 0.05$, and $p < 0.01$, respectively) the impact on net tuition revenue is minimal.

Table 11

Interaction Effects by Carnegie Group (Bachelor's Schools as the Reference Category)

Log Net Tuition Revenue (Log_NTR)	Fixed Effects
Unfunded Discount Rate (UDR)	0.007 (0.001)***
<i>Carnegie_N#c.UDR</i>	
Master's	-0.002 (0.001)**
Doctoral	0.001 (0.001)
Unfunded Discount Rate Squared (UDR2)	-0.000 (0.000)***
Log Undergrad Credit Hours (Log_UGCR)	0.455 (0.009)***
Log Graduate Credit Hours (Log_GRCR)	0.009 (0.004)*
<i>Carnegie_N#c.LOG_GRCR</i>	
Master's	0.067 (0.007)***
Doctoral	0.018 (0.015)
Percentage of Pell Grants (PELL_PCT)	0.002 (0.000)***
Percentage International Students (PCT_NR)	0.01 (0.001)***
<i>Carnegie_N#c.PCT_NR</i>	
Master's	-0.011 (0.001)***
Doctoral	-0.002 (0.002)
Previous Year Log Investment Income (L.Log_INV1)	0.001 (0.002)
Log Funded Aid (Log_FUND1)	0.008 (0.003)*
<i>Carnegie_N#c.Log_FUND1</i>	
Master's	-0.001 (0.005)
Doctoral	-0.023 (0.008)**
Previous Year Log Student Services Expenditures (L.Log_STUSERV1)	0.063 (0.007)***
Previous Year Log Instruction Expenditures (L.Log_INSTR1)	0.148 (0.009)***
Previous Year Log of Academic Support Expenditures (L.Log_ACAD1)	0.006 (0.006)
Log Tuition (Sticker Price) (Log_TUI1)	0.827 (0.018)***
Discount Rate (DR)	-0.004 (0.001)***
Discount Rate Squared (DR2)	-0.000 (0.000)***
Percentage Admitted (PAD)	-0.000 (0.000)
Constant	0.226 (0.199)
R2-within	0.71
R2-between	0.88
R2-overall	0.87
Rho	0.949

* p < 0.05, ** p < 0.01, *** p < 0.001

This is expected since the amount of institutional aid funded by restricted sources is far less than the amount funded by unrestricted sources in all Carnegie groups. The interaction terms show that there are variations in magnitude and direction of variables based on Carnegie classification (Miller, 2013).

Research Question 3

What other factors contribute to net tuition revenue?

The analyses of the overall model and those by Carnegie groups show that many factors significantly contribute to net tuition revenue. The model for all the institutions in the data file (Table 9) shows that in addition to the unfunded discount rate, undergraduate credit hours ($p < 0.001$), graduate credit hours ($p < 0.001$), number of international students ($p < 0.001$), previous year's expenditures on student services ($p < 0.001$) and instruction ($p < 0.001$), sticker price ($p < 0.001$), and discount rate ($p < 0.001$) have a significant impact on net tuition revenue. The year fixed effects show that apart from year 2008, all the other years had a significant ($p < 0.001$) positive association with net tuition revenue compared to year 2007.

The model shows that a 1% increase in undergraduate credit hours is associated with 0.46% of net tuition revenue. This indicates that additional undergraduate enrollment can increase net tuition revenue. A 1% increase in graduate credit hours is associated with 0.024% of net tuition revenue. This shows that even though graduate enrollment is associated with an increase in net tuition revenue, undergraduate enrollment has a greater positive association with net tuition revenue than does graduate enrollment. One explanation for this could be that an institution gains more revenue from undergraduate education (College Board, 2017a). Enrolling additional international students helps to increase net tuition revenue. The model indicated that a 1% increase in international students is associated with a 0.5% increase in net tuition revenue. The previous year's expenditures on student services and instruction have a significant impact on

net tuition revenue, which according to the model is associated with 0.05% and 0.143% of net tuition revenue, respectively. A 1% increase in sticker price is associated with a 0.56% increase in net tuition revenue. This shows that increasing tuition prices can increase net tuition revenue, but institutions need to be cautious that this would also require additional institutional aid to subsidize those who cannot or would not pay the increased tuition cost. The coefficient of the discount rate was negative and significant, showing a 1% increase of the discount rate is associated with a 0.7% decline in net tuition revenue. The quadratic discount rate term was significant, but the magnitude was very small.

The significant factors identified by the model are consistent with the prior study on public institutions (Hillman, 2012). The study on public institutions showed that enrollment, sticker price, and unfunded discount rate are positively associated with net tuition revenue.

Other Factors Impacting Net Tuition Revenue for Bachelor's Institutions

The results of the fixed effects analysis of Bachelor's institutions are shown in Table 10. The fixed effects model shows that the model explains 92% of the overall variance in log Net Tuition Revenue. The model shows that in addition to the unfunded discount rate, undergraduate enrollment ($p < 0.001$), percentage of Pell Grants ($p < 0.01$), percentage of international students ($p < 0.001$), prior year's expenditures on student services ($p < 0.001$) and instruction ($p < 0.001$), and sticker price ($p < 0.001$) are significant and contribute to increasing net tuition revenue. The percentage admitted is significant ($p < 0.05$) and negatively impacts net tuition revenue, but the magnitude of the impact is negligible. The year fixed effects were only significant in years 2008 ($p < 0.05$), 2012 ($p < 0.01$), 2013 ($p < 0.01$), and 2015 ($p < 0.01$), compared to 2007. Year 2008 had a negative association with net tuition revenue, whereas the other significant years had a positive association. This shows that in year 2008, other factors not included in the model are associated

with reducing net tuition revenue. In years 2012, 2013, and 2015, other factors not included in the model are associated with increasing net tuition revenue.

The model shows that a 1% increase in undergraduate credit hours is associated with a 0.5% increase in net tuition revenue. This suggests that additional undergraduate enrollment would help increase net tuition revenue. A 1% increase in the percentage of Pell Grants is associated with 0.2% increase in net tuition revenue. A 1% increase in international students is associated with a 1% increase in net tuition revenue. This suggests that increasing the number of international students enrolled can significantly help with net tuition revenue. Previous year's expenditures on student services and instruction are significant and are associated with increasing net tuition revenue by 0.04% and 0.09%, respectively. This may be due to better student retention associated with improved student-centered services. A 1% increase in sticker price is associated with a 0.85% increase in net tuition revenue. This suggests that institutions can increase the sticker price to earn more net tuition revenue, but this would also involve increased institutional aid to enroll the required number of students.

Other Factors Impacting Net Tuition Revenue for Master's Institutions

The results of the fixed effects analysis of Master's institutions are shown in Table 10. The fixed effects model shows that the model explains 95% of the overall variance in log Net Tuition Revenue. The model shows that a 1% increase in the overall discount rate ($p < 0.001$) is associated with a 1% decrease in net tuition revenue. This result was not expected, and further research needs to be done to understand this relationship.

The model also indicates that a 1% increase in undergraduate credit hours ($p < 0.001$) is associated with a 0.37% increase in net tuition revenue. A 1% increase in graduate credit hours ($p < 0.001$) is associated with a 0.07% increase in net tuition revenue. This suggests that

undergraduate and graduate enrollment are associated with helping to increase net tuition revenue, but undergraduate enrollment has a greater positive association. A 1% increase in the percentage of Pell Grants ($p < 0.001$) is associated with a 0.3% decrease in net tuition revenue. A 1% increase in student services ($p < 0.001$), instruction ($p < 0.001$), and academic support expenditures ($p < 0.001$) the previous year is associated with 0.07%, 0.27%, and 0.05% increase net tuition revenue, respectively. A 1% increase in the sticker price ($p < 0.001$) is associated with a 0.3% increase in net tuition revenue. The year fixed effects showed that apart from 2008, all other years had a positive, significant ($p < 0.001$) association with net tuition revenue. This indicates that other factors not included in the model are associated with positively contributing to net tuition revenue. This shows that the recession between 2008 and 2010 is not negatively associated with net tuition revenue.

Other Factors Impacting Net Tuition Revenue for Doctoral Institutions

The results of the fixed effects analysis of Doctoral institutions are shown in Table 10. The fixed effects model shows that the model explains 96% of the overall variance in log Net Tuition Revenue. The model shows that a 1% increase in the overall discount rate ($p < 0.001$) is associated with a decrease of net tuition revenue by 1%. This result was not expected, and further research needs to be done to understand this relationship. The economic model in Hillman's (2012) study also showed a negative relationship between funded institutional aid and net tuition revenue per FTE.

A 1% increase in undergraduate credit hours ($p < 0.001$) is associated with a 0.32% increase in net tuition revenue. A 1% increase in graduate credit hours ($p < 0.01$) is associated with a 0.02% increase in net tuition revenue. This suggests that while both undergraduate and graduate enrollment are associated with increases in net tuition revenue, undergraduate

enrollment is associated with a larger impact. A 1% increase in the percentage of Pell Grants ($p < 0.05$) is associated with a 0.2% decrease in net tuition revenue. A 1% increase in international students ($p < 0.001$) is associated with a 0.6% increase in net tuition revenue. This suggests that Doctoral institutions can significantly increase net tuition revenue by increasing international student enrollment. A 1% increase in student services ($p < 0.001$) and instruction expenditures ($p < 0.001$) the previous year is associated with 0.04%, and 0.25% increase in net tuition revenue, respectively. A 1% increase in sticker price ($p < 0.001$) is associated with a 0.4% increase in net tuition revenue. A 1% increase in the percentage admitted ($p < 0.001$) is associated with a 0.1% decrease in net tuition revenue. This suggests that less selective institutions earn less net tuition revenue. The year fixed effects showed that apart from 2008, all other years had a positive, significant association with net tuition revenue.

Summary

This study looked at how the unfunded discount rate impacted net tuition revenue and how this relationship varied by Carnegie classification. The study also reviewed factors that contribute to net tuition revenue. The analysis showed that unfunded discount rate did in fact impact net tuition revenue and that the impact varied by Carnegie group. Specifically, when analyzed with all the private nonprofit four-year and above institutions, a 1% increase in the unfunded discount rate was associated with a 0.5% increase in net tuition revenue with a peak unfunded discount rate of 35%. However, when analyzed by Carnegie group, the relationship between unfunded discount rate and net tuition revenue varied significantly across different types of institutions. It was found that, for Bachelor's institutions, a 1% increase in unfunded institutional aid was associated with a 0.7% increase in net tuition revenue with a peak unfunded discount rate of 39%. The analysis of Master's institutions showed that a 1% increase in

unfunded institutional aid was associated with a 0.4% increase in net tuition revenue, but the relationship was weaker compared to Bachelor's institutions. Doctoral institutions did not show that the unfunded discount rate was a significant predictor of net tuition revenue.

This study also looked at several other factors that could be predictors of net tuition revenue. The analysis showed that in addition to the unfunded discount rate, undergraduate credit hours, graduate credit hours, percentage of Pell Grants, percentage of international students, student services expenditures, instruction expenditures, academic support expenditures, tuition (sticker price), and percentage of admitted students are predictors of net tuition revenue. However, the factors and the impact of each also varied by Carnegie Classification group. An analysis of interaction terms confirmed this variation.

The initial model with all institutions showed that the unfunded discount rate, discount rate, undergraduate credit hours, graduate credit hours, percentage of international students, student services and instruction expenditures the previous year, and the sticker price are significant predictors and are associated with increasing net tuition revenue.

The analysis of the Bachelor's institutions showed that in addition to the unfunded discount rate, undergraduate credit hours, percentage of Pell Grants, percentage of international students, student services and instruction expenditures the previous year, and sticker price are significant and associated with increasing net tuition revenue.

The analysis of Master's institutions showed that unfunded discount rate is a significant predictor of net tuition revenue. The model also showed that the overall discount rate and the percentage of Pell Grants are significant but are associated with decreasing net tuition revenue. The model showed that undergraduate credit hours; graduate credit hours; student services,

instruction, and academic support expenditures the previous year; and sticker price are significant and are associated with increasing net tuition revenue.

The analysis of Doctoral institutions showed that unfunded discount rate is not a significant predictor of net tuition revenue. The model showed that the overall discount rate is significant but associated with decreasing net tuition revenue. The model showed that undergraduate credit hours, graduate credit hours, percentage of international students, student services and instruction expenditures the previous year, and sticker price are significant and are associated with increasing net tuition revenue. The percentage of admitted students and the percentage of Pell Grants are significant predictors of net tuition revenue, but are associated with decreasing it.

CHAPTER 5

CONCLUSION

Overview of Study

Tuition revenue is an important part of the budget for many private nonprofit four-year institutions. These institutions use institutional aid as a tool for enrollment and revenue management. Institutional aid is used to “craft the incoming class” based on institutional mission, and goals, as well as generate net tuition revenue. The NACUBO 2017 tuition discounting study highlighted the fact that in 2017-18 the annual percentage change in net tuition revenue per first-time full-time freshman is estimated to be -0.1%. The report also states that, using inflation-adjusted values, net tuition revenue change has been flat or declining in the last five years. Very few institutions can fund all the institutional aid, using restricted funds. The vast majority of the institutions use unfunded institutional aid for this purpose (NACUBO, 2017). Even though the generation of net tuition revenue and its relationship to unfunded institutional aid are important no conclusive research has been done on this topic for private nonprofit four-year institutions. Hillman (2012) completed a study that reviewed this relationship for public institutions and showed that there was an upper limit to generating net tuition revenue using unfunded institutional aid. This study serves to fill the void for private nonprofit four-year institutions.

Results

The purpose of this study was to determine how unfunded institutional aid relates to net tuition revenue for private nonprofit four-year institutions, whether it varies by Carnegie classification, and what other factors contribute to net tuition revenue. I used Delta Cost Project

data for this study. The dependent variable for all the models was Log Net Tuition Revenue. I will summarize my findings by factors used in the model.

Unfunded Discount Rate

The unfunded discount rate and its relationship to net tuition revenue is the primary focus of this study. The summary of the results of this relationship is shown in Table 12. When the fixed effects analysis was run for all the private nonprofit four-year and above institutions, I found that each 1% increase in the unfunded discount rate is associated with a 0.5% increase in net tuition revenue at a $p < 0.001$ significance level, but this relationship peaks at 35%.

Table 12

Summary of the Relationship of Unfunded Discount Rate with Net Tuition Revenue

Log Net Tuition Revenue (Log_NTR1)	Overall Model	Bachelor's	Master's	Doctoral
Unfunded Discount Rate (UDR)	0.005 (0.001)***	0.007 (0.001)***	0.004 (0.002)*	Not Significant
Unfunded Discount Rate Squared (UDR2)	-0.0000717 (0.000)***	-0.0000943 (0.000)***	Not Significant	0.000 (0.000)**
Turning Point	35%	39%		

Note: Standard error in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In a similar study for public institutions, Hillman (2012) found that there was a peak unfunded discount rate of 13%, after which net tuition revenue declines. The larger peak unfunded discount rate for private nonprofit four-year institutions can be explained by the higher sticker prices and larger grants provided at these institutions. For example, the average published full-time undergraduate tuition and fees at private nonprofit four-year institutions in 2017-18 was \$34,740, compared to \$9,970 at similar public institutions. The corresponding average net price

paid by students at private institutions was \$14,530, compared to \$4,140 at public institutions (College Board, 2017a).

When the fixed effects analysis was run by Carnegie group and the interaction effect test, I found that the relationship between unfunded discount rate and net tuition revenue varied significantly between Bachelor's, Master's, and Doctoral institutions. Specifically, for Bachelor's institutions, each 1% increase in the unfunded discount rate is associated with a 0.7% increase in net tuition revenue at a $p < 0.001$ significance level, but this relationship peaks at 39%. For Master's institutions, each 1% increase in the unfunded discount rate is associated with a 0.4% increase in net tuition revenue at a $p < 0.05$ significance level, but there is no significant peak rate. There is no significant relationship of unfunded discount rate with net tuition revenue for Doctoral institutions. This may be because the vast majority of Doctoral institutions had low unfunded discount rates compared to other Carnegie groups; for instance, 90% of Doctoral institutions had unfunded discount rates of less than 38%. The majority of Master's institutions also had low unfunded discount rates; for instance, 75% of Master's institutions had unfunded discount rates of less than 38%. A closer look at Bachelor's institutions showed that 231 institutions had unfunded discount rates over 39% in some years, and these institutions had 1,271 observations over the ten years of this study, with discount rates over this peak unfunded discount rate. This means that approximately 50% of the Bachelor's institutions had unfunded discount rates over 39% at some time over the period of the study. In 2015 alone, 200 Bachelor's institutions had unfunded discount rates over 39%, which should be cause for concern for administrators at these institutions.

This study confirmed the two hypotheses listed in Chapter 3. The first hypothesis which suggested that unfunded discount rate is related to net tuition revenue was confirmed by the

overall model, and by the Bachelor's and Master's models. The second hypothesis suggested that the relationship of unfunded discount rate with net tuition revenue varied by Carnegie classification. This, too, was confirmed with the varying magnitudes of the relationship between Bachelor's and Master's institutions, but no significant relationship for Doctoral institutions.

Undergraduate Credit Hours

Undergraduate credit hours was significant ($p < 0.001$) for the overall model, and the models by Carnegie classification (Table 13). The association with net tuition revenue was 0.46% for the overall model, 0.5% for Bachelor's, 0.37% for Master's, and 0.3% for Doctoral institutions. This shows that increasing undergraduate enrollment benefits institutions in all Carnegie groups.

Graduate Credit Hours

Graduate credit hours was significant ($p < 0.001$) for the overall model, and for the Master's and Doctoral models. The association with net tuition revenue was 0.024% for the overall model, 0.07% for Master's, and 0.02% for Doctoral institutions. This shows that Master's institutions benefit more from enrolling graduate students than Doctoral institutions. This is somewhat surprising, since I would expect Doctoral institutions to benefit more due to more services, such as teaching and research, provided by these students.

The results show that Master's and Doctoral institutions gain more net tuition revenue from undergraduate enrollment than graduate enrollment. This could be explained by the fact that graduate education costs more than undergraduate education (College Board, 2017a), enabling institutions to retain more revenue from undergraduate students.

Table 13

Summary of the Relationship of Other Factors with Net Tuition Revenue

Log Net Tuition Revenue (Log_NTR1)	Overall Model	Bachelor's	Master's	Doctoral
Log Undergrad Credit Hours (Log_UGCR)	0.460 (0.001)***	0.500 (0.014)***	0.37 (0.013)***	0.321 (0.021)***
Log Graduate Credit Hours (Log_GRGR)	0.024 (0.003)***	Not Significant	0.068 (0.006)***	0.024 (0.008)**
Percentage of Pell Grants (PELL_PCT)	Not Significant	0.002 (0.001)**	-0.003 (0.000)***	-0.002 (0.001)*
Percentage International Students (PCT_NR)	0.005 (0.001)***	0.01 (0.001)***	Not Significant	0.006 (0.001)***
Previous Year Log Student Services Expenditures (L.Log_STUSERV1)	0.05 (0.007)***	0.039 (0.011)***	0.071 (0.01)***	0.040 (0.011)***
Previous Year Log Instruction Expenditures (L.Log_INSTR1)	0.143 (0.01)***	0.090 (0.014)***	0.270 (0.015)***	0.249 (0.019)***
Previous Year Log of Academic Support Expenditures (L.Log_ACAD1)	Not Significant	Not Significant	0.045 (0.007)***	Not Significant
Log Tuition (Sticker + Price) (Log_TUI1)	0.563 (0.024)***	0.853 (0.041)***	0.287 (0.030)***	0.388 (0.045)***

Note: Standard error in parentheses.

* p < 0.05, ** p < 0.01, *** p < 0.001

Percentage of Pell Grants

Percentage of Pell Grants was significant for the Bachelor's, Master's, and Doctoral models. The association with net tuition revenue was 0.2% with the Bachelor's model (p < 0.01), but -0.3%, and -0.2% for the Master's (p < 0.001), and Doctoral (p < 0.05) models, respectively. A possible explanation for this is that Master's and Doctoral institutions may have to provide

additional institutional aid to Pell-eligible students compared to an average student, whereas Bachelor's institutions have to provide less aid to these students compared to an average student. Therefore, this may impact net tuition revenue negatively at Master's and Doctoral institutions. However, since the discount rate is much higher on average at Bachelor's institutions, the Pell Grants help to reduce institutional aid for these students. Therefore, Pell Grants have a positive influence on increasing net tuition revenue at Bachelor's institutions.

Percentage of International Students

The percentage of international students was significant ($p < 0.001$) for the overall model, and for the Bachelor's and Doctoral models. The association with net tuition revenue was 0.5% for the overall model, 1% for Bachelor's, and 0.6% for Doctoral institutions. This shows that international student enrollment can be an effective way to increase net tuition revenue for Bachelor's and Doctoral institutions. A closer look at the average distribution of international student enrollment shows that Doctoral institutions enroll 10%, and Master's and Bachelor's institutions enroll 3.5%. Despite the same average enrollment of international students, Bachelor's institutions retain more tuition revenue. This highlights the fact that international students receive scholarships and other institutional aid, even though they are not eligible to receive need-based aid. Carey (2014) highlights how international students use various resources to identify potential scholarship opportunities at United States educational institutions. The results of my study show that, while increasing international student enrollment can be associated with increasing net tuition revenue, it is not always.

Previous Year's Student Services Expenditures

The impact of the previous year's student services expenditures was small but significant ($p < 0.001$) for the overall model, and for the models by Carnegie classification. The association

with net tuition revenue was 0.05% for the overall model, 0.039% for Bachelor's, 0.07% for Master's, and 0.04% for Doctoral institutions. This may be due to increased student satisfaction with the student services provided, which may help with student recruitment and retention.

Previous Year's Instructional Expenditures

The impact of the previous year's instructional expenditures was significant ($p < 0.001$) for the overall model, and for the models by Carnegie classification. The association with net tuition revenue was 0.143% for the overall model, 0.09% for Bachelor's, 0.27% for Master's, and 0.25% for Doctoral institutions. This may be due to increased student satisfaction leading to improved retention.

Previous Year's Academic Support Expenditures

The association of the previous year's academic support expenditures was significant ($p < 0.001$) for the Master's model only. The association with net tuition revenue was only 0.045%. This is minimal.

Sticker Price

The association of the sticker price was significant ($p < 0.001$) for the overall model, and for the models by Carnegie classification. The association with net tuition revenue was 0.56% for the overall model, 0.85% for Bachelor's, 0.29% for Master's, and 0.39% for Doctoral institutions. Increasing the sticker price is an option for all Carnegie groups to increase net tuition revenue, but this needs to be accompanied by more institutional aid to meet enrollment targets.

Summary of Results

The results above show that for Bachelor's institutions, the largest association with increasing net tuition revenue is to keep the unfunded discount rate below 39%, increase

undergraduate enrollment, recruit more international students, and review sticker price. For Master's institutions, the greatest association with increasing net tuition revenue is to increase enrollment and review the sticker price. For Doctoral institutions, the greatest association with net tuition revenue is to increase enrollment, recruit more international students, and review sticker price.

This study highlights the fact that the vast majority of Doctoral and Master's institutions control their expenditures on institutional aid effectively, whereas almost half the Bachelor's institutions may be spending too much on unfunded institutional aid, thereby seeing a decline in net tuition revenue. This may be due to the lack of enrollment research at Bachelor's institutions. Larger institutions have the resources to invest in enrollment research, consequently strategically using aid to maximize tuition revenue. This provides support for the resource dependence theory where institutions use their resources to strategically position themselves to effectively manage their enrollment revenue. Since private nonprofit four-year institutions derive a significant portion of their budget from tuition revenue, resources should be devoted to revenue optimization.

Implications of the Study

This study shows that unfunded institutional aid can be used effectively to generate net tuition revenue at private nonprofit institutions. An important conclusion of this study is that this relationship between net tuition revenue and the unfunded discount rate varies by Carnegie group. This study highlights the fact that many institutions are following excessive tuition discounting practices that may be negatively impacting net tuition revenue. The NACUBO (2017) tuition discount study confirmed the fact that private nonprofit four-year institutions are not seeing significant annual net tuition revenue growth despite increasing tuition discount rates.

The results of this study should alert enrollment management professionals, higher education leaders, policy makers, and other decision makers that excessive tuition discounting practices can lead to reductions in net tuition revenue, and this study provides an empirical maximum discount rate that is associated with maximizing net tuition revenue.

Many Bachelor's institutions should be concerned about how much unfunded institutional aid is being allocated. Half of the Bachelor's institutions in this study had unfunded discount rates over 39%. University administrators need to review tuition discounting practices to ensure that net tuition revenue is not being negatively impacted. The money spent on unfunded institutional aid can be used for other institutional priorities, and the opportunity costs associated with these funds need to be reviewed. This study shows that having unfunded discount rates over 39% at Bachelor's institutions is associated with a decrease in net tuition revenue, and this decrease can have negative consequences on institutional finances. The NACUBO (2017) tuition discounting report showed that small institutions had an average institutional tuition discount rate of 51.7% for first-time full-time freshmen in 2017-2018, which should be cause for concern. While institutional aid is used to "craft a class" based on institutional priorities and to generate net tuition revenue, enrollment research using institutional data should be used to maximize the benefits of this aid.

Master's institutions can generate net tuition revenue using unfunded institutional aid, but the relationship is not as strong as that for Bachelor's institutions. There was also no significant upper limit in the Master's model, after which these institutions could see declines in net tuition revenue. However, the model with all institutions showed that there was a peak of 35% in the unfunded discount rate, for a positive relationship between unfunded institutional aid and net tuition revenue. Master's institutions should be cautious about having an unfunded discount rate

over 35%. In the study sample, over 25% of Master's institutions had unfunded discount rates over 35%. Administrators at these universities should review tuition discounting practices and consider other avenues to increase net tuition revenue.

Unfunded institutional aid did not have a significant relationship to net tuition revenue at Doctoral institutions. The study dataset showed that over 90% of Doctoral institutions had unfunded discount rates less than 38%. Since the model for all institutions had a peak of 35% for unfunded institutional aid, Doctoral institutions with unfunded discount rates over 35% should review their unfunded institutional aid strategies to identify ways to reduce it and use other factors, such as increasing enrollment, to generate more net tuition revenue.

This study shows that there are other factors that could be considered to generate net tuition revenue; these factors include increasing undergraduate enrollment, increasing international student enrollment, and considering increasing the sticker price. However, increasing the sticker price also involves providing additional institutional aid to enroll the required number of students (Breneman, 1994). Each institution has its own priorities and unique circumstances; therefore, it is important that institutions use their data to identify opportunities to strategically use institutional aid to maximize benefits.

Suggestions for Future Research

This study adds to the research literature on tuition discounting for revenue generation. There is an abundance of literature on tuition discounting for enrollment management but hardly any on tuition discounting for revenue generation. Although Hillman's (2012) study focuses on tuition discounting for revenue management at public schools, there are no conclusive studies on the effects of tuition discounting for revenue management at private nonprofit institutions. This study fills the void.

More research needs to be done on tuition discounting for revenue generation. This study grouped Carnegie 2010 classifications 15 (Very high research activity), 16 (high research activity), and 17 (Doctoral/Research) as Doctoral; classifications 18 (larger programs), 19 (medium programs), and 20 (smaller programs) as Master's; and 21 (Arts & Sciences) and 22 (Diverse Fields) as Bachelor's. Studying each of the classifications by itself without grouping them will provide a more granular analysis. It will be interesting to compare the results of a more granular analysis with mine to check if these groups make a difference.

Analyzing unfunded discount rates for first-time full-time freshmen and their relationship to net tuition revenue would be beneficial. Institutions typically use new financial aid strategies with first-time full-time freshmen. A study based on this group will more clearly show the association between institutional aid and net tuition revenue. This relationship can be further studied based on Carnegie groups, endowment levels, and selectivity levels.

Institutional aid is used for the recruitment of new students and the retention of continuing students. Studying the relationship between discount rates and retention would be valuable to identify how institutional aid affects persistence. It would be interesting to look at what other factors contribute to persistence. Again, this can be studied based on Carnegie groups, endowment levels, and selectivity.

The association of unfunded institutional aid and net tuition revenue can be studied based on endowment levels rather than Carnegie groups. The endowment level groups would have similar funded aid amounts and selectivity. This would allow comparisons based on institutional resources. The NACUBO (2017) study shows that in 2016-2017, institutions with over \$1 billion in endowment funded 29.6% of institutional grant aid with endowment funds, compared with 5.8% for those whose endowment is less than \$25 million.

Built beyond prior research that focused on tuition discounting for revenue management in public four-year institutions (e.g., Hillman, 2012), this study makes two major contributions to the field: first, I explored this topic in private four-year institutions; and second, my study discovered that unfunded discounting had differential effects on net tuition revenue across different Carnegie types of institutions. The finding indicates that it will be beneficial to analyze public institutions by Carnegie classification, as well. This could allow future studies to compare the relationship of unfunded discount rate to net tuition revenue between private and public institutions based on their Carnegie classifications.

Conclusion

Institutional aid is an important consideration in enrollment management. New students expect to see institutional aid in their financial aid package, and institutional aid is a key factor in student enrollment decisions. Therefore, institutions need to provide some amount of institutional aid to remain competitive and meet their educational missions. However, with the ever-increasing institutional aid expenditures (College Board, 2017b), institutions need to be strategic to ensure that the institutional aid expenditures are reaping the intended benefits. Particularly, when most of the institutional aid is funded by university operating budgets with competing opportunity costs, institutions need to ensure that they are not losing revenue due to excessive discounting practices.

This study reflects the literature, that institutional aid can be used to generate net tuition revenue, but this study goes further by showing that this relationship varies by Carnegie classification at private nonprofit educational institutions and indicates an upper limit after which net tuition revenue declines. This study also highlights the extent of the excessive tuition discounting practices and provides guidance on ways to increase net tuition revenue.

References

- Aldrich, H. E. & Pfeffer, J. (1976). Environments of organizations. *Annual Review of Sociology*, 2, 79-105.
- The Almanac of Higher Education 2017-2018*. (2017). *The Chronicle of Higher Education*, 43.
- Alstete, J. W. (2014). Revenue generation strategies: Leveraging higher education resources for increased income. *ASHE Higher Education Report*, 41(1), 1-138.
- Altringer, L., & Summers, J. (2015). Is college pricing power pro-cyclical? *Research in Higher Education*, 56(8), 777-792.
- Archibald, R. B., & Feldman, D. H. (2008). Explaining increases in higher education costs. *The Journal of Higher Education*, 79(3), 268-295.
- Baum, S., Johnson, M., & Lee, V. (2018). *Understanding College Affordability*. Retrieved from <http://collegeaffordability.urban.org/>
- Baum, S., Lapovsky, L., & Ma, J. (2010). *Tuition Discounting: Institutional Aid Patterns at Public and Private Colleges and Universities, 2000-01 to 2008-09*. Retrieved from <https://trends.collegeboard.org/sites/default/files/trends-2010-tuition-discounting-institutional-aid-report.pdf>
- Behaunek, L. (2015). *Tuition discounting at private higher education institutions and implications for revenue* (Doctoral dissertation). Retrieved from Proquest Digital Dissertations. (Document ID 1762721955)
- Bienen, H. (2012). The financial future of research universities. *Social Research: An International Quarterly*, 79(3), 631-634.
- Breneman, D. W. (1994). *Liberal arts colleges: Thriving, surviving, or endangered?* Washington, DC: The Brookings Institution.
- Browning, J. F. (2011). *Accounting for the relationship of the financial position of private baccalaureate-level and above institutions to tuition discount rates* (Doctoral dissertation). Retrieved from Proquest Digital Dissertations. (UMI No. 3449318)
- Cantwell, B. (2015). Are international students cash cows? Examining the relationship between new international undergraduate enrollments and institutional revenue at public colleges and universities in the US. *Journal of International Students*, 5(4), 512-525.
- Carey, K. (2014, January 06). The allure and quick fix of the full-pay foreign student. *The Chronicle of Higher Education*.
- The Carnegie Classification of Institutions of Higher Education*. (n.d.). Retrieved from

<http://carnegieclassifications.iu.edu/>

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

Curs, B. R., & Singell, L. D. (2010). Aim high or go low? Pricing strategies and enrollment effects when the net price elasticity varies with need and ability. *The Journal of Higher Education*, 81(4), 515-543.

The Delta Cost Project at American Institutes for Research. (2015). Retrieved from <https://deltacostproject.org>

Desrochers, D. M., & Hurlburt, S. (2016). *Trends in college spending: 2003-2013*. Delta Cost Project at American Institutes for Research.

Haveman, R. H., & Smeeding, T. M. (2006). The role of higher education in social mobility. *The Future of Children*, 16(2), 125-150.

Hegarty, N. (2014). Where we are now – The presence and importance of international students to universities in the United States. *Journal of International Students*, 4(3), 223-235.

Hillman, N. (2010). *Meeting need and buying prestige: An analysis of institutional aid expenditures among public colleges and universities* (Doctoral dissertation). Retrieved from Proquest Digital Dissertations. (UMI No. 3439290)

Hillman, N. (2012). Tuition discounting for revenue management. *Research in Higher Education*, 53(3), 263-281.

Hossler, D. (2000). The role of financial aid in enrollment management. In M. Coomes (Ed.), *New directions for student services* (pp. 77-90). San Francisco, CA: Jossey-Bass Publishers.

Hurwitz, M. (2012). How does institutional grant aid impact college choice? Retrieved from <http://media.collegeboard.com/digitalServices/pdf/advocacy/homeorg/institutional-grant-aid-college-choice-research-brief-120607.pdf>

Integrated Postsecondary Education Data System (IPEDS) (n.d.). Retrieved from <https://nces.ed.gov/ipeds/>

Katchova, A. (2013). Panel Data Models. Retrieved from <https://sites.google.com/site/econometricsacademy/econometrics-models/panel-data-models>

Martin, R. E. (2002). Tuition discounting: Theory and evidence. *Economics of Education Review*, 21(2), 125-136.

- Massa, R. J., & Parker, A.S. (2007). Fixing the net tuition revenue dilemma: The Dickinson College story. *New Directions for Higher Education*, 140, 87-98.
- McPherson, M. S., & Schapiro, M. O. (1998). *The student aid game: Meeting need and rewarding talent in American higher education*. Princeton, NJ: Princeton University Press.
- Miller, J. E. (2013). *The Chicago guide to writing about multivariate analysis* (2nd ed.). Chicago, IL: University of Chicago Press. Retrieved from http://www.press.uchicago.edu/books/miller/multivariate/multivariate_by_chapter.html
- NACUBO (2017). The 2017 NACUBO tuition discounting study. Retrieved from <http://www.nacubo.org/>
- Paulsen, M. B. (2001). Economic perspectives on rising college tuition: A theoretical and empirical exploration. In M. B. Paulsen & J. C. Smart (Eds.), *The finance of higher education: Theory, research, policy & practice* (pp. 193-263). New York, NY: Agathon Press.
- Powell, B. A., Gilleland, D. S., & Pearson, L. C. (2012). Expenditures, efficiency, and effectiveness in U.S. undergraduate higher education: A national benchmark model. *The Journal of Higher Education*, 83(1), 102-127.
- Pusser, B., & Marginson, S. (2013). University rankings in critical perspective. *The Journal of Higher Education*, 84(4), 544-568.
- Radwin, D., Conzelmann, J.G., Nunnery, A., Lacy, T.A., Wu, J., Lew, S., Wine, J., & Siegel, P. (2018). *2015-16 National Postsecondary Student Aid Study (NPSAS:16): Student financial aid estimates for 2015-16*. Retrieved from <https://nces.ed.gov/pubs2018/2018466.pdf>
- Redd, K.E. (2000, December). Discounting toward disaster: Tuition discounting, college finances, and enrollments of low income undergraduates. *New Agenda Series: USA Group Foundation* 3(2).
- Summers, J. A. (2004). Net tuition revenue generation at private liberal arts colleges. *Education Economics*, 12(3), 219-230.
- Trends in college pricing*. (2017). *Trends in Higher Education Series*. College Board Advocacy & Policy Center. Retrieved from <https://trends.collegeboard.org/college-pricing>.
- Trends in student aid*. (2017). *Trends in Higher Education Series*. College Board Advocacy & Policy Center. Retrieved from <https://trends.collegeboard.org/student-aid>
- Wellman, J. V. (2010). Improving data to tackle the higher education “cost disease.” *Planning for Higher Education*, 38(3), 25-37.

Wooldridge, J. M. (2003). *Introductory econometrics: A modern approach*. Mason, OH: South-Western.

Zhang, L., & Ness, E. C. (2010). Does state merit-based aid stem brain drain? *Educational Evaluation and Policy Analysis*, 32(2), 143-165.