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Funding of Higher Education: Variations in State Funding, Impacts of State Funding on Differential Tuition, and Variables Impacting Differential Tuition

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FUNDING OF HIGHER EDUCATION: VARIATIONS IN STATE FUNDING, IMPACTS OF STATE FUNDING ON DIFFERENTIAL TUITION, AND VARIABLES IMPACTING DIFFERENTIAL TUITION

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This dissertation is approved as a creditable and independent investigation by a candidate for the Doctor of Philosophy in Sociology and is acceptable for meeting the dissertation requirements for this degree. Acceptance of this does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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ABSTRACT

FUNDING OF HIGHER EDUCATION: VARIATIONS IN STATE FUNDING, IMPACTS OF STATE FUNDING ON DIFFERENTIAL TUITION, AND VARIABLES IMPACTING DIFFERENTIAL TUITION

MICHAEL HOLBECK
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Public higher education in the United States has seen many changes since the Morrill Act of 1862. Specifically, the funding of higher education has changed greatly over the last half century, from very low tuition and relatively high state subsidies to an increased reliance on tuition to fund higher education. While this funding change has been the national trend, the impact on specific states and universities has varied greatly. This study examines the funding variation between university peers, normalized using state general funds per resident student FTE, to analyze the variation of state funding between states as well as the differences in annual volatility. In addition, this study assesses the use of differential tuition for a case study university in relation to changes in state funding. Finally, this study examines which variables impact the use of differential tuition on undergraduate programs.

Survey data from eight institutions were analyzed to study the variations and annual changes in state support funding. Additionally, historical pricing and state funding data were used to analyze the impacts of state funding changes on the use of differential tuition. Finally, regression analysis was used to test if theories of cost-based pricing and consumer surplus could be used to explain the use of differential tuition at the case study university.

This study found that state support per resident state support student FTE vary greatly by university and that changes in funding can vary widely from year to year. Additionally, the analysis found a correlation between decreases in state funding and an increased use of differential pricing of undergraduate programs. Finally, the regression analysis indicated that theories of cost-based pricing and consumer surplus explained a significant portion of the implementation and variation in differential pricing at the case study university.

INTRODUCTION

The discussion of who should pay for public higher education has been an increasingly debated topic. As states' budgets become increasingly tighter, the decision of funding public higher education becomes increasingly difficult. In addition, media and public views on the topic range from free college education for all (or at least those under a certain income level), to views that college education is a private good and should be paid for by those individuals who benefit directly from higher education (Georgetown University Center of Education 2016). Scholars join the discussion as they attempt to quantify the public versus private good of higher education (Baum, Ma, and Payea 2010; Bloom, Hartley, and Rosovsky 2007; Marginson 2007). While these views and analyses discuss higher education at a high theoretical and philosophical level, there is even more complexity as one dives into the funding of higher education. The truth of higher education financing is that states fund higher education very differently and because of the complexity and multiple missions of public universities, it is very difficult to get accurate comparisons between universities and across states. The equitable distribution of resources to the instructional units within a university adds yet another layer of complexity, as the cost of the services offered by these instructional units varies greatly between disciplines. Finally, as the debate regarding who should pay for higher education continues, state budget cuts force universities to take action on these theories and philosophies. The cost of educating students varies greatly by instructional unit, but the projected income of graduates of these various programs also varies greatly. The combination of all of these complex factors leads to several research questions: Who is

paying for higher education? Can we explain why are they paying for higher education? What differences exist in how higher education is funded?

The debate on higher education funding gets caught between the principles of public higher education dating back to the Morrill Act's establishment of land grant institutions and the financial realities faced by state policy makers. The Morrill Act of 1862 established land grant institutions to provide educational opportunities for all citizens who wanted to take advantage of the opportunity. While this goal of access to higher education may not be lost on state policy makers, the reality is that keeping this access to higher education must be weighed against other funding needs such as health care, safety, and K-12 education (Hovey 1999; Kramer 2011; Tandberg 2010). These difficult funding decisions many times go against higher education because higher education can raise tuition to help offset its funding needs.

As funding at the state level decreases for higher education, the debate on the topic in the media continues to increase. Media sources such as *The New York Times, Boston Globe*, and *U.S. News & World Report* have discussed ways and reasons that states and the federal government should increase funding for public higher education (Cohen 2003; Fieldhouse 2014; Horowitz 2015). Not all media sources are against the decreasing support of higher education; some suggest that states should stop subsidizing higher education (Skorup 2013). The principal debate for many of these articles focuses on the public versus private benefits of higher education.

While some doubt the public benefit of higher education, suggesting that benefits such as higher taxes due to increased salaries of college graduates are more a case of correlation rather than causation, many researchers have tried to analyze and explain the

benefit to society (Baum et al. 2010; Bloom et al. 2007; Skorup 2013). The research and analysis on the private versus public benefits of higher education largely support the fact that both benefits exist; however, acknowledging that they exist has not ended the theoretical debate on who should pay. Additionally, a gap in the literature regarding who is currently paying keeps policy makers and researchers from having a common understanding of the present situation. Achieving a common understanding of who is currently paying is a very helpful step in providing a baseline for this debate.

The difficulty in having a common understanding of who is currently paying is twofold. First, the state funding of that state's resident students is not readily available data for each state. While the amount of state appropriations to a university can be obtained through the Integrated Postsecondary Education Data Systems (IPEDS) website, this state appropriation in many states includes much more than simply the amount of state funds for instruction of students. It includes such entities as Agricultural Experiment Stations, Cooperative Extension Services, and medical schools, for example. Therefore, without a way to accurately analyze the state funds provided specifically for these entities housed within the university, it is impossible to ascertain the true state general funds for instructional costs. Surveys that have tried to determine this number have experienced difficulty eliminating all of these entities and have been limited to a subset of large institutions (University of Colorado Boulder 2017). Additionally, resident student FTE are not available without the use of a survey tool. The combination of these factors result in a lack of a common understanding of the funding differences across states.

The second difficulty in fully comprehending who is paying for higher education is understanding the differential tuition pricing policies between universities. As

discussed by Wolniak (Schmidt 2016), it is extremely difficult for higher education experts, much less students, to understand the price of a specific degree. Wolniak stated that three researchers (Schmidt 2016) attempted to determine the price of a specific program when differential tuition was evident and achieved three-way consensus only forty-four percent of the time. Therefore, even these experts could not agree on the stated price of a specific program with differential tuition more than fifty-six percent of the time. This difficulty is important because tuition bills for undergraduates can vary forty percent or more based on the academic program (Schmidt 2016). The challenge in understanding state support of resident students, as well as the tuition price students in varying majors pay, leads to a lack of common understanding of who is currently paying for higher education, and therefore impedes data-informed discussions on operationalizing who policy makers and researchers believe should be paying for higher education.

Within universities there remain similar questions: What is an equitable funding of instructional units within a university? What programs, if any, should be charged differential tuition and how much? The internal allocation of resources within a university is a very important bridge between state funding and differential tuition pricing. Changes in state support funding may affect departments differently; as state support decreases, universities may choose to do across-the-board cuts or may choose to target their cuts. Additionally, as the use of differential tuition increases, the units that apply this differential to their programs may receive additional resources. Finally, the budget model of the university can affect all of these changes; whether the university has a rules-based model, such as a responsibility center management model, or a centralized

model, will impact how these resources are allocated. To fully understand impacts of state funding and impacts of differential tuition, universities must also examine the equity of their instructional resources allocations. Holbeck and Santos (2017) provide a methodology for estimating the equitable distribution of instructional resources between instructional units taking into account all resources, including differential tuition, and the impact of market forces and cost structures. While this analysis provides a methodology to analyze equitable distribution of resources, it does not address the rationale for charging those differential tuition rates to some instructional units, but not others.

All of these complex variables have kept discussion of who should pay for higher education at a more philosophical than pragmatic level. We propose this situation is caused by a lack of common understanding of who is paying for higher education and why are they paying for it. The goal of this study is to contribute to this discussion by providing an accurate analysis of funding from state general funds per resident student FTE across university peers, as well as testing theories explaining the implementation of differential tuition. As university leaders and policy makers try to enact needed cuts to balance budgets or implement decisions about which programs to increase differential tuition on, research surrounding these topics will be needed to help inform such decisions.

Purpose Statement

The purpose of this study is to examine funding from state general funds per resident student FTE across university peers, as well to test theories explaining the implementation of differential tuition to determine:

1. the variation of state funding per resident student FTE across peer institutions

2. the differences in annual volatility of state funding among state support institutions
3. if increased use of differential tuition is related to changes in state funding
4. which variables impact the use of differential tuition

Significance of Study

The reduction of state support for higher education is resulting in increasing pressure on higher education finance. There is concurrent pressure on higher education to remain affordable. Philosophical debates about who should pay for higher education based on public versus private benefits continue throughout the country, as do debates on equity and access to higher education as tuition prices continue to increase. As policy makers and researchers struggle with these questions, a common understanding of current funding levels by state and an understanding of current differential pricing structures and rationales will help inform the decisions on these important questions. Examining how states are currently funding higher education can inform the political discussions within a specific state, as well as provide researchers a common understanding of funding differences in order to more accurately assess the public good return of higher education. Understanding the rationale for current differential pricing structures can inform the discussion on the equity/inequity of charging differential tuition, as well as provide information to support the philosophical questions of who should be paying for higher education. For decisions to be made on higher education going forward, there needs to be a common understanding of the current structure, and this research will help advance that needed knowledge.

Definitions

Cost of Instruction

Cost of instruction for each department was defined as the weighted average of the cost per CIP (Classification of Instructional Program) of departmental peers for the courses taught by that department using the Delaware Cost Study.

Differential Tuition

Differential tuition was defined as a published variation in rates based on a specific discipline, major, or field of study. This could be assessed specifically as different tuition rates or by using fees, charges, etc. Some variations are based on a specific course, due to costs specific to that course, and not applicable to all courses within the discipline, major, or field of study were not considered differential tuition (examples include field trip charges and lab fees associated with particular courses).

Estimated State Appropriations per State Support Resident FTE

Estimated State Appropriations per State Support Resident FTE was defined as the result of dividing the Net State Appropriations for Core Teaching and University Overhead by the Net State Supported Resident Full-Time Equivalent Estimate.

Mid-Career Salary

Mid-career salary was defined as the median salary for alumni with degrees in a specific major with 10 plus years of experience, as reported by PayScale.com (2017).

Net State Appropriations for Core Teaching and University Overhead

Net State Appropriations for Core Teaching and University Overhead was defined using the IPEDS definition for state appropriations less any state appropriations not directly related to Core Teaching or University Overhead. IPEDS defines state appropriations as the amounts received by the institution through acts of state legislative

bodies, excluding grants, contracts, and capital appropriations. Funds reported in this category are for meeting current operating expenses, not for specific projects or programs (U.S. Department of Education 2017).

Net State Supported Resident Full-Time Equivalent Estimate

Net State Supported Resident Full-Time Equivalent Estimate was defined using the IPEDS definition of full-time equivalent students less non-resident and non-state supported students. IPEDS definition uses the full-time equivalent students plus the undergraduate part-time enrollment times 0.60 for public four-year institutions plus the part-time graduate enrollment times 0.36 for public 4-year institutions.

Price Setters

Price setters are defined for the purposes of this paper as those involved in the price setting decisions at a university. This term is meant to encompass all individuals involved in the price-setting process, as well as to take into account that the process will vary significantly between universities and states.

Starting Salary

Starting salary is defined as the median salary for alumni with degrees in a specific major with zero to five years of experience, as reported by PayScale.com.

Organization of the Study

Chapter 1 of this study contains the introduction, statement of the problem, purpose statement, significance of the study, and definitions of terms. Chapter 2 contains the literature review and previous literature focusing on state support of public higher education, studies of state support per student FTE, studies of resource allocation within a university, history of differential tuition, and differential tuition implementation. Chapter 3 describes the theory and methodology used in this study. Chapter 4 contains the results

and findings of this study. Chapter 5 provides a discussion of the of the findings, limitations of the study, conclusions based on the data, and recommendations for practice and further study.

LITERATURE REVIEW

This literature review will be comprised of five sections: State Support of Public Higher Education, Studies of State Support per Student FTE, Studies of Resource Allocation within a University, History of Differential Tuition, and Differential Tuition Implementation.

Researchers and policymakers study funding and equity in higher education in many contexts, including student access, faculty and staff compensation, and public benefits versus private returns. As state support of higher education has decreased, an increased focus has been put on higher education funding. This focus includes an examination of historical state support of higher education as well as differences between states in funding of higher education. In recent history, an increased emphasis has been placed on resource allocation methodologies within universities as well as the equity, or perceived equity, of the resource allocation within universities (American Academy of Arts & Science 2016a, 2016b; Engell and Dangerfield 1998; Newfield 2009; Peseau and Orr 1980; Rosinger, et al. 2016; Slaughter 1993; Slaughter and Cantwell 2012; Strauss and Curry 2002; Whalen 1991). Finally, as tuition has increased, researchers and institutions have increasingly assessed the pricing structures in higher education. Differential tuition is one method now used to offset a loss in state support resources, in addition to covering increasing expenses. Since the students cover these increased costs instead of the state, some argue that differential tuition is a way to increase revenue without across-the-board tuition increases, as well as to make the purchasing of these differential products more equitable (Yanikoski and Wilson 1984). This literature review will discuss state support of higher education as a backdrop to the discussion of funding

differences per resident student FTE, analysis of resource allocations within universities, and the increased use of differential tuition.

State Support of Public Higher Education

The funding landscape of higher education has changed significantly over the last two decades, with public universities receiving decreasing levels of state support (American Academy of Arts & Science 2016a, 2016b; Feldman 2012; State Higher Education Executive Officers Association 2015; National Association of State Budget Officers 2014). Public and political pressure to keep costs low has also had an impact on higher education (Kim and Jo 2015). The philosophic question of what kind of good is higher education (e.g., a public good or a private good), along with impact of pricing on different demographics applies yet another layer of pressure on higher education finance (Allen and Wolniak 2015; Chingos 2016; Delisle and Dancy 2016; Georgetown University Center of Education 2016; Marginson 2007).

Many theories address the decrease in state funding of higher education. These theories reside on a wide spectrum and with many different viewpoints. Some are primarily financial, suggesting that the reduction of state support is simply a function of the "balancing wheel" effect as states try to fund multiple needs including healthcare, safety, and education (Hovey 1999; Kramer 2011; Tandberg 2010). As state funds fail to grow at the pace of the needs placed against them, higher education feels the burden because it has the ability to generate revenue through tuition, which typically does not exist for the other needs of state government.

On the other end of the spectrum from the simply financial "balancing wheel" theory, there exist those who theorize that anti-intellectualism in America is having an

impact on how society views higher education. They suggest this anti-intellectualism is affecting the funding and support higher education receives. This negative attitude towards education, scholarly activities, and practitioners can divide the general population's view on state support of higher education. There are those who support the state's funding of higher education and others who view the state's investments in higher education as funding the upper class. The latter group may view state funding of higher education as a tax of the majority of society, who in their estimation do not benefit from higher education (Romero 2016).

Other theories suggest that society views higher education as a transactional good. The dual credit program, where high school students can obtain high school credits as well as college credits while in high school, is at the center of this controversy. Some argue that this program benefits students by lowering their cost of obtaining postsecondary education because they start college with some credits already completed at a significantly reduced rate or, in some states, at no cost to the individual. Opponents suggest that dual credit exposes higher education to a possible lack of rigor, and focuses too much on seat time and standardized testing (Krueger 2006). In addition to the transactional nature of dual credit, there is also a financial component. In some states such as Utah, the state, school districts, and the postsecondary institutions share the cost of dual credit (Krueger 2006) so that students can obtain these credits at no cost. In other states, it is estimated this program saves millions of dollars for both the parents and the state because of the students' decreased time to degree in college. Although this appears to be a win for the state and the students or their parents, it can be very costly for

universities that receive reduced tuition for these courses without state funding to offset the discounted tuition (Krueger 2006).

The implementation of dual credit varies largely by state; some states provide the education completely free, while others charge discounted tuition. The funding is also variable; some states provide resources for the program, others share the burden between districts, institutions, and the state, while others rely solely on institutions to cover the financial burden. This variation in the state support of dual credit also exists in the overall funding variation between states. Political, economic, and structural variables have all been found to impact the funding of state higher education (Kramer 2011; McClendon, Hearn, and Mokher 2009; Weerts and Ronca 2006). These variables impact and result in variations in state support of higher education between states. Regardless of which theory one subscribes to, or which states one analyzes, it can be seen that state funding of higher education has been decreasing. This decrease in state funding results in increased pressure on higher education finance.

In response to these pressures, higher education has had to look at both how much it is charging, whom it is charging, and how resources are allocated internally. This self-reflection has resulted in many universities changing to a more decentralized, or responsibility centered budget model (American Academy of Arts and Science 2016a; Hearn, et al. 2006; Whalen 1991). The change in price of tuition, allocation of those price increases, as well as allocation of the changing resource base within a university all pose questions about equity.

The changing higher education landscape will continue to put pressure on university leadership, political leaders, and researchers to understand how higher

education is currently being funded, and will fuel the debate about current equity in state support, resource allocations within universities, and pricing of higher education, as well as equity going forward. As universities adapt to the new funding of higher education, it will be important to understand the existing differential pricing structures and the philosophy and equity behind differential tuition. In addition, as universities transition from centralized budget models to rules-based budget models, the questions of equitable distributions of instructional resources within the university will be of paramount importance (Hearn et al. 2006). This dissertation aims to help fill the gap, both by discussing the history and use of differential tuition, as well as by presenting a methodology of estimating the equitable distribution within an institution. Combining these two concepts will provide a baseline for understanding the interlocked policy decisions of pricing and resource distribution.

Studies of State Support per Student FTE

While understanding the history of state support of higher education is important, it is equally vital to understand that state support of higher education is not uniform across all states or even for all public universities within a state. Comparing funding for higher education across states can be normalized in multiple ways, such as funding per capita, funding per student FTE, and funding per resident student FTE. Many analyses and studies have used these normalized data either to compare institutions or as variables in an analysis (Kramer 2011; State Higher Education Executive Officers Association 2015; University of Colorado Boulder 2017; Weerts and Ronca 2006; Western Interstate Commission for Higher Education 2016). While funding per capita may originally seem like a valid way to get comparable state funding data, this measure ignores the fact that

demographics vary greatly by state. Therefore, a state with an older population or a state with a lower percentage of students going into higher education would be expected to have lower funding. In addition, in states that have fewer students in higher education, the funding per student is actually higher than the per capita number may suggest. Therefore, funding per student may be a preferred measure.

However, funding per student FTE may is not as straightforward as one may think. Two issues influence the definitions of state funding and student FTE. The first is the fact that FTE includes both resident students and non-resident students. Strict state funding per FTE does not account for the fact that many non-resident students pay a higher tuition. The theory behind non-resident students paying a higher tuition than resident students is that the state's dollars are going to subsidize the cost of education for the students of that state, as opposed to the non-resident students who are paying closer to the true cost of instruction (Carbone and Jenson 1971; Nelson 2008; Mumper 2001; Southern Educational Board 1976). Therefore, a university with a high number non-resident students will have additional resources from these students' higher tuition and may be able to operate with less state general funds. Similarly, this example institution would be expected to be supported less by its state dollars because the state is interested in subsidizing its own students, not those from other states. Reciprocity agreements between states can lower the costs for non-resident students of specific states, but typically, these students still pay a higher price than resident students.

The second issue with regard to state funding per student FTE is due to the term state funding itself. State supported universities are complex organizations and within these organizations exist non-instructional missions, such as Agricultural Experiment

Stations, Cooperative Extension Services, medical complexes, Economic Development Institutes, and Research Consortiums, for example. These non-instructional missions operated within the university typically also receive state dollars. Therefore, comparing the state dollars at a university with an Agricultural Experiment Station to a university without an Agricultural Experiment Station would result in the first university appearing to have additional state general funds per student FTE, all else equal, even though the Agricultural Experiment Station dollars are earmarked and cannot be used for funding student instruction.

Popular secondary data that exists when it comes to state support per student FTE includes the IPEDS, State Higher Education Executive Officers Association's State Higher Education Finance Survey, and a study by the University of Virginia. The IPEDS data include all state general funds going to a university (including Agricultural Experiment Station, Cooperative Extension, and other non-instructional units) and all student FTE (U.S. Department of Education 2017). The State Higher Education Executive Officers Association's State Higher Education Finance Survey maintains the same FTE definition as the IPEDS survey, but changes the state support definition by excluding spending for research, as well as agricultural and medical education, to make the state support funding analysis more comparable across states (State Higher Education Officers Association 2015). Finally, the University of Virginia conducts a survey in an attempt to ascertain the instructional state support per resident student. This survey requests data from universities using the IPEDS enrollment FTE definition but limit it to resident students. The Virginia study also suggests that state appropriations exclude hospitals, extension services, and other non-instructional units. Unfortunately, some of

the data points in the survey results still include Agricultural Experiment Stations, Cooperative Extension, and medical schools (University of Colorado Boulder 2017). This study also consists mainly of large institutions with In-State FTE alone of greater than 20,000 FTE. As a result of the lacking research on comparable state support per resident FTE data, we arrive at the following research questions:

1. How does state funding per resident student FTE vary between peer institutions?
2. Does state funding per resident student FTE follow similar patterns for each peer institution, or does year-to-year variation occur by institution?

Studies of Resource Allocation within a University

Resource allocation models within universities have been a popular topic in many articles (Hearn et al. 2006; Whalen 1991). Whalen (1991) focused on the implementation of the responsibility centered management model at Indiana University. This work includes a very detailed analysis of making the transition to a rules-based allocation model. It also discusses the benefits associated with moving to such a model, which include aligning incentives for increased income and reduced costs, as well as aligning authority with responsibility. Hearn et al. (2006) provide a case study of the University of Minnesota as they transitioned to an incentives-based budget system, finding that going to this model brings to the forefront the difficult pursuit of access, quality, and efficiency. They also found that this approach made the university's investment patterns and cross-subsidies more transparent. While these articles discuss rules-based allocation and transparency going forward, they did not focus on the equity of past distributions.

As discussed in Holbeck and Santos (2017), the current literature that does focus on equity fails to take into account market forces and cost structures (Newfield 2009; Santos 2007; Volk et al. 2001) when analyzing resource allocation within a university. In their analysis, Holbeck and Santos found that market forces and cost structures do account for the variation in funding between instructional units at their case study university. They also found that, contrary to prior studies, the allocation of resources is equitable across discipline types; previous studies had found that certain discipline types were underfunded, such as the humanities. The allocation of instructional resources within an institution is an important link between state funding decreases and pricing. As state funding decreases and universities are required to make decisions on budget reductions and tuition increases, understanding the equity of their current allocation can help inform decisions on tuition increases, such as the use of differential tuition. Understanding which programs are truly high cost, when assessed against peers, can help inform which programs should possibly have differential tuition applied to them.

History of Differential Tuition

The principles of access to higher education in America date back to the Morrill Act, which established land grant institutions to provide educational opportunities for all citizens who wanted to take advantage of the opportunity. State supported higher education maintained this access principle by states providing the majority of resources to institutions, thus requiring a low financial contribution from individuals, through the 1960s (Nelson 2008; Toutkoushian 2001; Ward and Douglass 2005).

In recent years, however, contributions from states have not kept pace with the cost of instruction and state support has decreased as a percentage of the overall budget

(American Academy of Arts & Science 2016a, 2016b; Feldman 2012; State Higher Education Executive Officers Association 2015; National Association of State Budget Officers 2014; Ward and Douglass 2005). In addition to the decrease in higher education funding from the state, there has also been a shift in the view of the benefits of higher education. While higher education was traditionally seen as offering both public and private benefits, the prevailing view has shifted to seeing it as more predominantly a private benefit (Ward and Douglass 2005). As a result of these factors and an increase in the cost of higher education, tuition and fees rose at two to three times the rate of inflation in the 1980s, and 51 percent above inflation in the 1990s (Toutkoushian 2001). In addition to across-the-board tuition increases, universities looked for other ways to fill the gap between shrinking resources and rising expenses. One such method was tuition differentials.

Prior to the 1970s, tuition differentials between programs were primarily found in professional programs, such as medicine and law. Other program differentials were found between resident and non-resident rates (Nelson 2008). In the 1970s, many institutions began to charge differential tuition between undergraduate and graduate courses; this change from having one flat rate was often in response to the recognition of higher costs (Saupe and Stephens 1974). In the 1980s, tuition differential increased and gained support as a mechanism for securing much-needed revenue with relatively low risks to enrollment (Yanikoski and Wilson 1984). Although the implementation of differential tuition may have been cost and revenue driven, the academic discussion on the topic is much more complicated than just dollars and cents.

The issue of equity with regard to the implementation of differential tuition has advocates on both sides of the discussion. There are those who have argued that uniform tuition is fair (Southern Regional Education Board 1976). Additionally, many institutions have rejected or continue to consider the impacts of differential pricing prior to implementing the practice (Gordon 2009; University of Washington Office of Planning and Budgeting 2011). Other institutions, such as University of Illinois and the University of Michigan have had price differentials between both high-cost majors and upper division coursework for some time (Yanikoski and Wilson 1984). While there remain those opposed to differential tuition, the number of universities having at least one undergraduate program with differential tuition or fees continues to increase from 45 percent in a 2008 study to 57 percent in a 2011 study (Nelson 2008; Reed 2011). The implementation of these programs has been steadily increasing since the mid-1990s (Cornell Higher Education Research Institute 2012). There also appears to be a difference in the type of institutions implementing differential tuitions. Public doctoral degree granting institutions are more likely to have some form of differential tuition when compared to public master's- and bachelor's-level public institutions (Ehrenberg 2012).

While many studies discuss the impact of price on enrollment in higher education, (Crous 2015; Hemelt and Marcotte 2009; Jackson and Wethersby 1975; Perna et al. 2005) significantly fewer look at the impact of differential tuition price or its impact on students and discipline-specific enrollment (Nelson 2008; Strange 2015; Ward and Douglass 2005); there appears to be a lack of research that examines in which majors are cost and differential tuition closely tied, and in which majors they are not. Many of these studies focus simply on the majors that most frequently use differential tuition, such as

engineering, business, nursing, and professional schools, but ignore other majors that have differential tuition or are high cost (Strange 2015; Ward and Douglass 2005; Western Interstate Commission for Higher Education 2016). As seen in Nelson (2008), research has been conducted on differential tuition for residents versus nonresidents, and upper and lower divisions, but a lack of research remains on differential tuition by undergraduate program.

Differential Tuition Implementation

Although differential tuition by undergraduate program has been an understudied topic, other types of differential tuition have been studied and rationale provided. Differential tuition for resident versus non-resident students is one of the first forms of differential tuition, and is justified by the fact that states want to subsidize their residents' undergraduate education and therefore charge a higher cost to non-residents who in theory should not be subsidized (Carbone and Jenson 1971; Nelson 2008; Mumper 2001; Southern Educational Board 1976). Although it is believed these higher rates for non-residents reflect true costs, universities also adjust prices for non-residents based on reciprocity agreements and revenue and capacity concerns (Mixon and Hsing 1994; Rizzo and Ehrenberg 2004).

Non-resident pricing, attendance, and politics can be complicated issues for universities. As discussed, higher pricing for non-residents can be thought of as universities charging these students full cost while discounting the resident rates based on the state subsidy. This, as it turns out, is not what happens in practice. States and/or schools many times enter reciprocity agreements with other states (Rizzo and Ehrenberg 2004). In general, these agreements lower the price for residents of State A below the

stated non-resident price in State B. In return, students from State B can attend universities in State A at a price below the stated non-resident price. Some of these agreements are program specific, but often the agreements are more general. The goal of these agreements is to help drive efficiencies and lower the price of higher education for students of particular states.

Reciprocity agreements can eliminate the need for participating states to maintain separate and possibly costly programs in some fields, such as veterinary science (West 2015). By having reciprocity agreements between two states, students from state A who want to study a specific program that may not be offered in their state can go to the reciprocity state B that has that program at a rate lower than the posted non-resident rate. This allows both states to specialize in different programs, but allows lower priced access to a wider variety of programs for the citizens of both states. Many times, these reciprocity groups are geographical (National Association of Student Financial Aid Administrators 2017).

These agreements can be politically sensitive, as they charge students from other states less than full price, in theory. They also can be considered to take spots in competitive programs away from resident students. On the other hand, reciprocity agreements can be considered good political and financial moves as they increase the options for their states' citizens and can drive efficiencies and increase revenues if a university has excess capacity.

In addition to non-resident tuition as a revenue policy lever, differential tuition by major can be used to adjust revenues. In current literature, it is suggested that differential tuition has been used as a revenue policy level to replace lost state general fund support.

Strange (2015) states that in the face of declining state support, many universities have introduced differential tuition. Nelson (2008), through interviews, also found that most institutions implement differential pricing in the face of declining state support and high costs.

Current literature discusses high-cost majors that typically have differential tuition, such as engineering, business, and nursing (Strange 2015), but fails to discuss high-cost majors that may not have correspondingly high differential tuition, such as biology and education (Middaugh et al. 2003).

As state funding of higher education continues to decrease, universities must change the way they operate. While the national trend has been decreased funding for higher education, the amount of state funding can vary by state. In addition, state economies vary widely and the size of the decrease may vary based on the current situation in that state's economy. As universities adjust to the changes in funding, we have seen an increase in the use of rules-based allocation methodologies to align incentives and funding with responsibility. These changes result in a need to analyze the equity of these allocations as universities increase tuition to offset the state budget cuts. Once universities understand the equitable distribution of current resources, they can be better informed as they implement differential tuition on their programs. As a result of gaps in this literature, we have developed the following research questions:

Research Questions

1. How does state funding per resident student FTE vary between peer institutions?
2. Does state funding per resident student FTE follow similar patterns for each peer institution, or does year-to-year variation occur by institution?

3. In the face of decreasing state support, are public universities pricing education more like a for-profit firm?
4. Do the theories of cost-based pricing and marginal utility, specifically consumer surplus, explain the differential tuition pricing structures in higher education?

THEORETICAL FRAMEWORK AND METHODOLOGY

This chapter will describe the theoretical framework for the analysis of who is currently paying for higher education and why, as well as the methodology used to study this question in this study. The chapter will begin by discussing the theoretical framework for state funding per resident FTE. Next will be the conceptual framework for differential tuition and instructional costs. The type of studies done will be discussed and a description of the study provided. Finally, the methodology used in this study for state support per resident student FTE and differential pricing will be discussed.

Theoretical Framework for State Funding per Resident FTE

State funding per Resident FTE is a tool used to estimate the funding of a state in their residents' education. In our theory, the state provides a subsidy to its residents, allowing them to pay a lower tuition rate than non-residents, who in theory are not subsidized. Therefore, we theorize that a state's support of its resident students is a valid measure of that state's investment in higher education.

To obtain comparable state appropriations for our peer group of universities, we must remove all state funds not directly related to core teaching or university overhead. This would include Agricultural Experiment Stations, Cooperative Extension Services, Animal Disease Research and Diagnostic Labs, medical schools, and other programs not related to core teaching and overhead. Once these units' state general funds are removed from the IPEDS reported state general funds, the remaining state general funds should be comparable for peer universities.

Secondly, the state supported resident student full-time equivalent must be calculated. To get comparable data, we must remove all non-state supported students, as

well as all non-resident students, from each university's IPEDS full-time equivalent student data. In addition, if any specific units, such as medical schools, are removed from the state general fund appropriations, the corresponding student FTE must also be removed from the student FTE calculation.

As a result of completing these two steps, we theorize that we will have comparable state appropriations per state-supported resident student FTE. As mentioned, based on the theory that state support provided to institutions of higher education is to benefit the residents of that state, we believe that these data will be good indicators of both the level of state appropriations and of the year-over-year trends in state support of higher education by state.

While other options for comparing state support of higher education, such as funding per capita or funding per student FTE, are alternative methods for comparing states, we would suggest that these measures have larger limitations than our state funding per resident student FTE. Funding per capita fails to account for age demographic differences between states, as well as the varying levels of higher education demand between states. These limitations of funding per capita would cause states that have a much older age demographic (e.g., Arizona) to look as if they are under funding higher education because of the large population and relatively smaller demographic of typical college age students, resulting in smaller demand for higher education than other states.

Additionally, state funding per student FTE also has its limitations compared to our preferred measurement of state funding per resident state-support student FTE. The difference in these two measures is that our measure uses only resident state-support

student FTE as opposed to all student FTE. Using all student FTE includes non-resident students who pay a higher price than resident students do. In general, non-residents pay this higher tuition because they are not receiving the subsidy from the state in which they are attending school, as opposed to residents of that state who are receiving the subsidy. In theory, the non-residents are paying closer to the actual cost of education than the residents. So if a school has a significant portion of its students who are non-residents, it may not need as much state funding because it is charging all of these non-residents a price close to the actual cost of instruction. Therefore, comparing state funds per student of this university with a significant number of full-paying non-residents, with a school that has primarily residents who are subsidized by the state would result in the state with non-residents appearing to fund education at a lower level. In actuality, the additional tuition paid by the non-residents could result in the funding to be equal between the two schools.

While we believe our preferred methodology of using state funds per resident state-support student FTE is most accurate, it is not without its own limitations and assumptions. Using this method requires the assumption that states do not subsidize non-residents. We know that this is not true because reciprocity agreements lower the out-of-state price for students from certain states, which would suggest that states do subsidize non-residents. There are a variety of reasons that states would be willing to subsidize non-residents, such as: increased revenue at little or no marginal cost if capacity exists, a desire to increase the population as some non-residents may become residents after graduation, or a need for an increased educated workforce to drive economic development. While these limitations exist and should be analyzed further, that analysis

is beyond the scope of this study. Therefore, we suggest that state funding per state support resident student FTE is the best available measure.

Theoretical Framework for Price Differentials

In state-supported higher education, in sharp contrast to a for-profit business, universities sell their product at a price below the cost of production (Winston 1999). Therefore, since universities are not-for-profit institutions, the higher the subsidy, the further the price of the product is below the cost of production. Public universities charged very little tuition through the 1960s, because the heavy subsidy from the state was sufficient to cover the cost of instruction and overhead (Nelson 2008; Toutkoushian 2001; Ward and Douglass 2005).

Although nonprofits do have a non-distribution constraint, which means that no one individual owns them and they cannot distribute profits as a for-profit firm does, there are no restrictions pertaining to cross subsidizing within a multiproduct non-profit organization (Hansmann 1981; Weisbrod 2009). One can see how unequal subsidies could have existed as higher education was heavily state funded. Even if one ignores market forces influencing faculty salaries, it would still be reasonable to assume that cost discrepancies existed; for example, education in chemistry requires the purchase of chemicals and lab supplies, while English does not. Even if this subsidy did exist and chemistry majors were receiving a higher subsidy due to the higher cost of their program, this discrepancy in subsidies may not have received much attention because the costs of higher education for both students were being covered almost completely.

Following the 1960s, tuition began to be a larger factor in higher education financing. As state support decreased and costs increased, higher education began to

increase tuition. In the 1970s, tuition increases were primarily across all majors. While the cost discrepancies discussed still existed, the state was still funding the majority of the cost of public higher education so the fact that the chemistry student was getting a higher subsidy might still not have received much attention.

In the 1980s, 1990s, and into the 2000s, the cost of tuition increased substantially and contributions from state general funds decreased (American Academy of Arts and Science 2016a, 2016b; Feldman 2012; State Higher Education Executive Officers Association 2015; National Association of State Budget Officers 2014; Toutkoushian 2001; Ward and Douglass 2005). Universities continued to have to increase price, either across the board in tuition increases, or though differential tuition by major.

The process for increasing tuition prices or adding differential tuition to undergraduate majors varied by state and institution. In our case study institution, the process for adding differential tuition is controlled at the highest level by a board of regents. Although the board of regents has final approval, the process of adding differential tuition involves many more people. The process at the case study institution for adding differential tuition typically comes from a department, which makes a request to a dean, who then vets the request with the Vice President for Academic Affairs and the finance office, who then makes a recommendation to the President. The President then has final jurisdiction at the university as to whether the request for differential tuition is forwarded on to the board of regents. Finally, the board of regents makes the final approval or denial of the program fee request. This is the process of our case study institution, which will undoubtedly be different at other institution who may or may not have a board of regents and who may follow a significantly different process. Some

universities may require approval from legislative bodies, while others may have a more decentralized pricing process and the president of the university may have the final authority.

As a result of the varying structures of tuition and specifically differential tuition approval, we have chosen to use the term “price setters” to encompass all individuals who play a role in pricing tuition, and specifically differential tuition, at a university. Similarly, we chose this generic term so that it can be applicable to all of the varied processes that may exist in tuition price setting at universities.

As state funding continues to decrease price setters at public universities must weigh their mission of providing access to higher education with the financial reality of balancing their budgets. The choices made by these individuals impact the price of education, which in turn impacts access to higher education. Raising tuition may decrease the ability for lower socio-economic families to send their students to college, especially with stagnating need-based student aid and slumping incomes for less advantaged families (Dougherty and Kienzl 2006).

A conflict theory perspective on education may suggest that education serves to reproduce inequality and would suggest that raising the price of education is an additional way to keep current social stratification in place (Bowles and Gintis 2007; Collins 1971). Other views on education through a conflict theory perspective suggest that the chance of success differs greatly between economic classes. These differences can be caused by variations in economic stability, home ownership, and social capital both for the student in the classroom and the parents trying to navigate the complex educational system (Bourdieu 1985; Colman 1988; Conley 2001, Sadovnik 2007). These disadvantages in

addition to typical economic differences add to the pressure for price setters to keep tuition low and not add yet another barrier to access.

We suggest an alternative to the conflict perspective; we suggest that price setters instead use a rational choice perspective while weighing their options. Rational choice can be viewed as theory that informs individuals about how to best achieve their objectives. It involves a calculated approach where individuals weigh potential outcomes and probabilities and justify their actions based on a means-ends calculus (Blackwell 2000; Ostrum 1991). In our analysis we assume price setters will use a rational choice approach as they make price setting decisions. They will use this approach in evaluating the students' views of the need and benefits of education. In addition, they will use this approach to evaluate student's willingness to pay based on each degree's financial impact on their estimated starting salary.

As the price setters at universities have weighed their options, many chose to use differential tuition (Nelson 2008). To analyze why this occurred, we propose the use of two economic theories within the constraint of the nonprofit organization definition. The first theory is cost-based pricing in which a firm prices its product to ensure that it is profitable, or at least that it can cover its cost (Courcoubetis and Weber 2003). While we suggest that state supported universities use this theory, we must remember it within the constraint of the non-profit definition. Recall that non-profits cannot distribute profits, but they can cross subsidize within a multiproduct organization such as a university (Hansmann 1981; Weisbrod 2009). As universities continue to become more reliant on tuition and less reliant on state subsidies, we suggest that they will operate more like a for-profit firm than they have in the past, and that cost-based pricing theory will

increasingly inform university pricing. It is important to note that as states decrease the funding of state supported higher education, universities will still behave and operate as non-profits. We are suggesting here that their pricing strategies will increasingly use the theories of for-profit firms, but we are not suggesting that state support universities will become for-profit.

The second theory that we propose is the economic theory of marginal utility, specifically looking at consumer surplus. Consumer surplus is an economic measure of the difference between what a consumer would pay for a good or service versus what was actually paid. It is important to note that consumer surplus is not based on a consumer's ability to pay, but is instead based on what they would be willing to pay.

There are many difficulties in trying to analyze an individual's consumer surplus, especially in their educational choices. Each individual will be willing to pay a different amount for their education, based a variety of variables. These variables could include the prestige or internal value of getting a degree, the individual's enjoyment of education, the student and/or their parent's financial situation, the price of obtaining that degree, and the financial benefit of getting a degree, to name a few.

Willingness-to-pay variables are not easily measurable for university price setters. For example, the university is not able to estimate how much two students' individual willingness to pay varies based on their internal value of getting a degree. For one student, the internal value of being a college graduate may be extremely important and therefore this student would be willing to pay a large amount for a degree just because of the internal value in addition to the financial gains that come with being a degree holder.

The other student may not get any internal value from having a degree and is only interested in the financial gains that come with being a degree holder.

In this example, assume the cost of a degree is Y. Then assume the first student is willing to pay $50,000 just for the internal value of being a degree holder plus the financial gain of being a degree holder of $X, and the other student is willing to pay $0 for the internal value in addition to the financial gain of being a degree holder of the same $X. The resulting consumer surplus for the first student ($50,000 + $X - $Y = student #1's consumer surplus) would be higher than the second student ($0 + $X - $Y = student #2's consumer surplus). Of course, the price setters at the university have no way of knowing that the first student's willingness to pay and resulting consumer surplus is $50,000 more than the second student and even if they did they would not be able to set two separate "sticker prices" for the two consumers. They may be able to adjust the net price through discounting and scholarships, but that discussion is outside the scope of this paper.

Since university price setters are limited to one "sticker price" per program, they must use the information that they have available to set a price that allows the institution financial stability, without reducing the consumer surplus for the student too much, or to a negative amount. Reducing the consumer surplus too low or to a negative amount would result in a decrease in enrollment.

The university in its price-setting model can only easily estimate two of the suggested variables that impact a student's consumer surplus for all students, namely, the price of obtaining that degree and the financial benefit of the student getting that degree. The other variables, such as internal value, are not easily obtainable and vary greatly by

student. Even more, the university is able to control only one of these, which is the price of the degree. Therefore, as institutions price education going forward, they will want to be careful not to increase the price on specific majors above a student's willingness to pay, or else one would expect to see a drop in enrollment in that major. Therefore, we propose that universities will increase the differential tuition on the majors that they perceive to have the highest consumer surplus using the information they have. Noting that universities really have information only on their price and the economic return on investment for the student, we propose that they will see majors with the highest starting salary as the majors with the highest consumer surplus, all else equal, and will therefore price those majors higher than a major of similar cost with a lower starting salary. Using the theories shown here, we developed the following research questions;

3. In the face of decreasing state support, are public universities pricing education more like a for-profit firm?
4. Do the theories of cost-based pricing and marginal utility, specifically consumer surplus, explain the differential tuition pricing structures in higher education?

In order to test these research questions, we propose two hypotheses using cost-based pricing theory. The first hypothesis (H1) is that as state support decreases the implementation of pricing differentials will increase. The second hypothesis has two parts; (H2a) the first part is that one of the variables that drives differential tuition is the cost of instruction.

In addition to cost of instruction, in the second hypothesis we introduce variable #2, expected starting salary, based on consumer surplus theory. As the university decides how to raise tuition, it will consider both cost of instruction (variable #1) and expected

starting salary (variable #2). Price setters will try to ensure that all majors have a positive consumer surplus for prospective students, while trying not to negatively affect enrollment (or at least minimize the negative impact on enrollment). Therefore, we add to the second hypothesis (H2a) that expected starting salary would also play a role in determining the price of a specific major. Combining these two variables, we arrive at Equation 1.

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + e_i \quad (1)$$

In Equation 1, we estimate, for each discipline, a price that takes the general form specified in Equation 1, where y_i represents the price charged per student credit hour in a discipline i, x_{1i} represents the cost of discipline i, x_{2i} represents the expected starting salary of discipline i, and e_i represents the random component of price per student credit hour. In this case, β_1 measures the change in price per student credit hour given a one-unit change in the cost of instruction. Similarly, β_2 measures the change in price per student credit hour given a one-unit change in the expected starting salary.

We maintain that cost-based pricing and consumer surplus are the best theories we can use to explain differential tuition in higher education. Because of the limited literature on the subject, nothing suggests that other variables affect differential tuition pricing. In our findings section, we will analyze our error terms to see if they are patterned in such a way as to suggest the existence of a third variable that we have mistakenly omitted. This two-variable model may seem overly simplistic amidst the complexity of higher education funding, controversial distribution of benefits (public versus private good), complex political arenas and organizational hierarchies (taxpayers,

legislatures, governing boards, and state governments), not to mention the science (or art) of pricing for businesses in general. We suggest that all of the complexity of higher education may actually lead to a simplified thought process for price setters, so they are able to navigate all of the stakeholders and are able to easily articulate the rationale for a program-specific differential tuition.

In addition to running Equation 1, for the starting salary of a discipline, Equation 2 will be run where y_i represents the price charged per student credit hour in a discipline i, x_{1i} represents the cost of discipline i, x_{2i} represents the expected mid-career salary of discipline i, and e_i represents the random component of price per student credit hour. In this case, β_1 measures the change in price per student credit hour given a one-unit change in the cost of instruction. Similarly, β_2 measures the change in price per student credit hour given a one-unit change in the expected mid-career salary.

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + e_i \quad (2)$$

Comparing the results from the regression in Equation 1 to the results of Equation 2 may provide some information regarding whether universities are using starting salaries or mid-career salaries to estimate the consumer surplus of students. Our hypothesis is that as students are looking at universities and estimating their repayment of student loans they are going to look at the starting salary, which in turn will cause universities to use starting salaries as opposed to mid-career salaries in their analysis of consumer surplus, even though mid-career salaries are probably a better proxy of lifetime earnings.

This theoretical framework for price differentials assumes that all of the programs analyzed are privy to a portion (as decided by the university) of the state general funds subsidy. If some of the programs are privy to a portion of the state general funds but other

programs are not, then this theoretical framework would not be applicable. Looking at an extreme example, assume a university has only four programs and two are privy to state general funds and the other two programs are required to be self-supporting without state general funds. We would expect the state-supported programs to behave more closely to the pricing structures of the 1960s, where even though cost differentials in programs existed, the substantial state funding allowed very low tuition rates to be charged to all programs and therefore differential tuition was not used because of the subsidy. Counter that with the way we would expect the two self-supporting programs to behave. We would expect these self-supporting programs to rely heavily on differential tuition to adjust the cross-subsidy (if any) between the two programs based on cost of instruction and consumer surplus.

As shown in this example, state subsidized programs would be expected to operate and price very differently than unsubsidized not-for-profit programs. As a result, programs of these two types should not be comingled in the proposed regression analysis, as the non-state subsidized programs would be expected to be outliers because of the differential pricing required for their sustainability.

Conceptual Framework for Instructional Cost

As seen in Equations 1 and 2, instructional costs are expected to be an explanatory variable for the differential tuition charged for various programs. Holbeck and Santos (2017) provide an approach for analyzing the cost of instruction in higher education, which includes all resources and uses institutional peers and the Delaware Costs Study Database to estimate the cost of instruction. They used this methodology to analyze equity within our case study institution. We will use this methodology both for

generating a cost of instruction estimate for our regression analysis, as well as to discuss the equity among colleges at the university studied.

For this analysis, we define the instructional costs for a unit as the expenditures of peer universities with similar programs. Conceptually, Holbeck and Santos (2017) defined costs as the financial resources an academic unit *would* surrender in order to provide its instructional services if the prices and quantities of its various inputs were identical to those of its peers (which, by definition, provide substantively similar instructional services using a similar instructional design). This methodology of estimating cost will serve this study well, as it will help to align costs specific to a program in our case study with the instruction services and instructional design with that of its peers, which, all else equal, will help control for quality and instructional design of a specific program. In order to discuss these costs, we will review the assumptions about the variables that influences these costs used in Holbeck and Santos (2017).

Assumptions on Instructional Cost Drivers

On a very basic level, we model the academic unit as a producer of instructional services, which it delivers through coursework and other learning activities, using the National Association of College and University Business Officers (NACUBO) definition for instruction expenses.

Instructional expenses are activities that are part of the University's instructional program to communicate educational content and include general academic, vocational/technical, special session, community education, and preparatory/remedial activity. All expenses associated with these instructional activities, including personal services (salary and benefits of individuals involved) and all operating expenses

associated with these activities (such as travel, contractual services, supplies, and equipment) are accounted for as instructional costs.

The instructional services of a college are its *outputs*; whereas, the personnel services and operational goods and services a college uses to provide its outputs are its *inputs*. A college's vision, mission, and strategic goals inform the design of instructional programs with which a college transforms inputs into outputs. We refer to this transformational process as a college's *instructional design*. In general, inputs and instructional-design characteristics drive instructional costs per student credit hour.

Examples of input characteristics could include the composition of instructional faculty ranks and the extent of faculty qualifications, both of which are suggested to drive the prices of inputs.

> Faculty ranks: Holding all else constant, the prices of inputs rise—and, thus, a college's instructional costs per student credit hour rise—as the share of faculty members who hold senior, tenured ranks rises. This change is because, on balance, a seasoned, tenured faculty member—one who holds the rank of full professor, for example—earns a higher salary than does an early career, tenure-track faculty member or a non-tenure-track, adjunct faculty member.
>
> Faculty qualifications: Holding all else constant, the prices of inputs rise—and, thus, a college's instructional costs per student credit hour rise—as the demand in the academic labor market for a faculty member's qualifications rise. This is because, on balance, a faculty member with

qualifications that are in relatively high demand earns a relatively high salary.

While these are a few suggested input characteristics, many more input characteristics that exist but are unknown to the authors could drive price. Additionally, these input variables may not be true in all settings; as salary compression and salary inversion exist at various levels across various universities, there could be completely different variables that drive input prices. Therefore, instead of attempting to identify all of the variables or analyzing the validity of the examples shown here, the authors opt for a peer-based model as will be discussed later.

Instructional-design characteristic examples include instructional-faculty workload, the share of instructional expenses not attributable to instructional-faculty services, the highest degree offered in a discipline, and the institution's Carnegie Basic Classification.

Faculty workload: Holding all else constant, a college's instructional costs per student credit hour rise as its faculty members' instructional workloads fall. This change is because the quantity of instructional faculty members must rise in order for the college to supply a given quantity of instructional services.

Highest degree offered in the discipline: Holding all else constant, a college's instructional costs per student credit hour rise as the highest degree it offers in a discipline rises. This change is because, relative to undergraduate instruction, graduate instruction typically requires small class sizes and more hours spent advising, mentoring, and researching.

Carnegie Basic Classification: Holding all else constant, a college's instructional costs per student credit hour rise as the number of programs in which its institution offers the terminal degree rises, as the level of research activity at its institution rises, and as the representation of science, technology, law, and business in its institution's curriculum rises. The Carnegie Basic Classification reflects these instructional-design characteristics.

Conceptual Model for the Instructional Equity Analysis

Using the assumptions and methodology described here we estimate, for each discipline within each academic unit, a conditional mean: the average instructional costs per student credit hour based on the peer universities selected by each department. This average instructional cost is used in Holbeck and Santos (2017) as well as for the instructional cost variable in regression Equations 1 and 2. The equation we are estimating to get the instructional costs per student credit hour is specified in Equation 3. In this equation, y_i represents the instructional costs per student credit hour in a discipline for institution i, x_{1i} through x_{ni} represent n institution-i, discipline-specific input and instructional-design characteristics, and e_i represents the random component of instructional costs per student credit hour.

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + \cdots + \beta_n x_{n,i} + e_i \quad (3)$$

For example, suppose x_{1i} represents the share of instructional faculty members in the discipline who hold the rank of full professor—an input characteristic—and x_{2i} is an indicator variable equal to 1 if the doctoral degree is the highest degree offered in the discipline and 0 otherwise—an instructional-design characteristic. In this case, β_1

measures the change in instructional costs per student credit hour given a one-unit change in the share of instructional faculty members who hold the rank of full professor. Similarly, β_2 measures the change in instructional costs per student credit hour given that a doctoral degree (as opposed to, say, a master's degree) is the highest degree offered in the discipline.

We can think about the right-hand side of Equation 3 as the conditional mean of y_i—that is, the average instructional costs per student credit hour in a discipline at institution i, conditioned on institution-i's discipline-specific characteristics that drive these costs—plus the random component, e_i. As such, we write Equation 3 as Equation 4, where, $E(y_i \mid x_{1,i}, x_{2,i}, \dots, x_{n,i})$, represents the conditional mean of y_i.

$$\mathrm{y}_i = E(y_i \mid x_{1,i}, x_{2,i}, \dots, x_{n,i}) + e_i \tag{4}$$

To appreciate more intuitively the conditional mean in this analysis, suppose $E(y_i \mid x_{1,i}, x_{2,i}, \dots, x_{n,i})$ takes the form specified in Equation 5, where $\beta_0 = \$200$, $\beta_1 = \$0.10$, and $\beta_2 = \$50$.

$$E(y_i \mid x_{1,i}, x_{2,i}) = \underbrace{\$200}_{\beta_0} + \underbrace{\$0.10}_{\beta_1} x_{1,i} + \underbrace{\$50}_{\beta_2} x_{2,i} \tag{5}$$

In this example, the characteristics that drive institution-i's instructional costs per student credit hour for this discipline are the share of instructional faculty members who hold the rank of full professor (x_{1i}) and the highest degree offered (x_{2i}) only. Suppose fifty percent of institution-i's instructional faculty members in the discipline hold the rank of full professor (thus, $x_{1i} = 50$) and the doctoral degree is the highest degree offered in the discipline (thus, $x_{2i} = 1$). According to Equation 5, the conditional mean

of instructional costs per student credit hour for this discipline at institution i is \$255, because:

$$E(y_i \mid 50, 1) = \underbrace{\$200}_{\beta_0} + \underbrace{\$0.10}_{\beta_1} \times \underbrace{50}_{x_{1,i}} + \underbrace{\$50}_{\beta_2} \times \underbrace{1}_{x_{2,i}} \quad (6)$$
$$= \$255$$

So far, we have expressed the conditional mean of instructional costs per student credit hour as a *known* function of various characteristics: in Equation 3 we specified the function in general form (as a function of x_{1i} through x_{ni}), and in Equation 5 we specified it, as an example, in specific form (as a function of x_{1i} and x_{2i}, only). In reality, the conditional mean of instructional costs per student credit hour is an *unknown* function of various characteristics. As such, we must estimate it.

In principle, we could estimate the conditional mean for each discipline within each academic unit by estimating (using, say, ordinary least squares regression) the model specified in Equation 3, thereby ascertaining $\hat{\beta}_0$, $\hat{\beta}_1$, $\hat{\beta}_2 \ldots \hat{\beta}_n$, the estimates of β_0, β_1, $\beta_2 \ldots \beta_n$, respectively. Then, we could multiply this discipline-specific conditional mean times the number of student credit hours the academic unit produced in that discipline in a given fiscal year. Summing across all disciplines the unit instructed and dividing by all student credit hours the unit provided would yield an estimate of a unit's instructional costs per student credit hour.

To execute this approach requires, for each discipline and for a large sample of institutions, data on instructional costs per student credit hour (the y_i term in Equation 3) and data on various characteristics (the x_i terms in Equation 3). This approach also requires access to a large sample of institutions' financial and credit hour generation information, as well as a properly specified model of the unknown and unobservable

process that generates instructional costs for each discipline (e.g., Equation 3). As we have neither access to such a data set from a large number of institutions, nor discipline-specific cost driver models, we proposed an alternative approach using the same conceptual framework, but instead of accessing each individual institution's data, we use the Delaware Cost Study Database.

Our study included all academic departments from a public research university. The total instructional resources (as defined by NACUBO) for each department were analyzed for each department for a single fiscal year. This data was then compared using CIP (Classification of Instructional Program) codes to the Delaware Cost Study Database, which contains instructional expenses data from over 200 institutions, and has been described as affording a rational view of differentiated direct costs and credit hour production on which various decision-making tools can be built (Carrigan 2008).

In line with our conceptual framework, we propose to estimate the average instructional costs per student credit hour based on the discipline-specific, instructional costs of the unit's peer institutions. We define a unit's peer institutions as those that provide substantively similar instructional services using substantively similar inputs and instructional designs.

Conceptually, then, we assume that peer institutions incur instructional costs per student credit hour according to a common, unobservable (and, thus, unknown) function of institution-specific characteristics—for example, we assume Equation 3. Based on discipline-specific data (averaged across peer institutions) on the instructional costs of peer institutions, we estimate, for each discipline within each unit, the conditional mean

of instructional costs per student credit hour. Our peer-group approach consists of three steps.

First, we obtained the Classification of Instructional Programs (CIP) code for each course taught at the university. Each course that an academic unit instructs corresponds to one or more fields of study. The National Center for Educational Statistics assigns to each field of study a Classification of Instructional Programs (CIP) code. The CIP taxonomy ranges from two-digit codes corresponding to general fields of study—for example, CIP 04 (Architecture and Related Services)—to four- and six-digit codes corresponding to specific fields of study—for example, CIP 04.09 (Architectural Sciences and Technology) and 04.0902 (Architectural and Building Sciences/Technology).

Thus we obtained the single corresponding four-digit CIP code for each course that each academic unit instructed in a given fiscal year. This course CIP-code information is typically readily available from an institution's office of academic affairs. The Delaware Cost Study database reports instructional costs for fields of study identified by, at most, four-digit CIP codes. Thus, in our approach, we must identify courses with four- or two-digit CIP codes, only. Once each course taught by the university had a corresponding CIP code attached to it, we then identified peer groups.

In the second step of our peer-group approach, we selected, for each department within each academic college, 10 to 15 institutions from the most-current edition of the Delaware Cost Study database; these selections consist of institutions that the corresponding academic-unit's leader identifies as department peers. Hereafter, we refer to these peer groups as departmental peers. Academic-unit leaders looked at the highest

degree offered, size of the peer program, comparison of the department to the university's mission (in Volk et al. [2001], this is could be considered centrality), and overall university Carnegie Classification, as well as any other factors deemed important by the academic leader pertaining to quality. These peers were then vetted and approved by deans of the respective colleges as well as the Vice President for Academic Affairs of the university.

The Delaware Cost Study provided a good source of data from which to derive instructional costs, but this methodology is not without limitations. Since this is a voluntary survey response, not all schools are not represented. While the group of universities that participate in the Delaware Cost Study is around 200 annually, the limited pool may have resulted in less than optimal peer selections. In addition, some data, such as distribution of faculty ranks or a measure of program quality between the case study institution and the peer institutions, were not available so unit leaders had to select peers with limited knowledge and limited choices. Despite limitations of the data set and the methodology used, we still suggest that the Delaware Cost Study provides the best-known source for estimating cost of instruction. Although we acknowledge the limits of the study here, it is also important to acknowledge that eight of the 16 peer institutions identified by our case study university for analysis of funding per resident student FTE did also participate and were identified as peers in the Delaware Cost Study. This is a sample of the overlap of the two studies and the quality options available in the Delaware Cost Study peer selection.

In addition to departmental peers, we selected, for the institution as a whole, 15 institutions from the database; these selections consist of institutions that the Vice

President for Academic Affairs identifies as university peers. Hereafter, we refer to this peer group as institutional peers. Finally, we selected the whole group of universities with a similar Carnegie Classification type as the case study university. Hereafter, we refer to this group as national peers. By completing the analysis three times with three different peer groups, we aim to add validity to our departmental peer group analysis.

After all of the peers were chosen, we estimated each academic unit's average instructional costs per student credit hour based on the discipline-specific instructional costs of peer institutions, i.e., the conditional means. Data for instructional costs for a single peer institution are not available from the Delaware Cost Study database; rather, only data averaged across peer-group institutions are available.

Therefore, we selected the peer group for a specific department (in the departmental peer analysis) and retrieved the average instructional costs for each CIP for that peer group[1]. We then multiplied the average direct instructional costs per student credit hour times the associated number of student credit hours the academic unit produced in a given fiscal year. Summing across all courses the academic unit instructed and dividing by all student credit hours the academic unit provided yields the estimate of an academic unit's direct instructional costs per student credit hour.

Patterns in instructional costs based on the Delaware Cost Study database are consistent with patterns in instructional costs in higher education more generally. Specifically, instructional costs vary more widely across disciplines for a given institutional type, than across institutional types for a given a discipline (Middaugh,

[1] Note the hierarchy for CIP matching for department peers was as follows: 4-digit CIP from department peers, 2-digit CIP from department peers, 4-digit CIP from institutional peers, 2-digit CIP from institutional peers, 4-digit CIP from national peers, 2-digit CIP from national peer. This was done so that every credit hour taught by the university had a corresponding average instructional cost per student credit hour.

Graham, and Shahid 2003). For example, engineering programs at national peers incur, on average, instructional costs per student credit hour somewhat equal to engineering programs at comprehensive institutions, on average, but psychology programs at national peers incur, on average, instructional costs per student credit hour significantly lower than engineering programs at either institution.

As we know, input and instructional design characteristics drive these patterns in instructional costs per student credit hour across disciplines and institutional types. Presumably, based on these patterns, input and instructional design characteristics vary more widely across disciplines for a given institutional type, than across institutional types for a given a discipline (Middaugh, Graham, and Shahid 2003). Thus, taken together, these summary statistics support our conceptual framework in general and our peer-group approach in particular, with which we estimate average instructional costs per student credit hour in a discipline, conditioned on discipline-specific input and instructional-design characteristics that drive these instructional costs.

Type of Study

In order to operationalize the conceptual theoretical frameworks described here, an exploratory case study was used. This study gathered data on state support per resident student FTE for a group of peer institutions in order to analyze the variations in funding and the volatility across years. It also contains discussion on the equity of the distribution of instructional resources within a single research institution. Finally, it analyzes the use of differential tuition within a research university and a comparison of these tuition differentials to national cost of instruction data and salary by major data.

Description of Study

This study is composed of three parts. The first part will contain a survey conducted of 17 peer institutions regarding state support per resident full-time equivalent students and an analysis of the variation in funding and the variation over years by institution. The second part of this study will analyze how universities distribute their instructional resources, including differential tuition as discussed in part one, to test whether there is an equitable distribution when taking into account cost structures and market forces, as well as testing if there are any specific disciplines that are underfunded. The third part will include an analysis of differential pricing in higher education and the testing of theories as to why universities price the way they do.

State Support per Resident Student FTE

The literature review identified a lack of literature and data for normalized state support per resident student FTE. Based on this lack of literature, a survey tool was developed to capture the data for our group of peer institutions. The survey tool was then expanded to help explore the research questions. The first step in designing the survey tool was to give each participating university a similar starting point for its state support appropriations and full-time equivalent student enrollment. In order to do this, data was collected from the Integrated Postsecondary Education Data Systems (IPEDS) website (U.S. Department of Education 2017). This data was then populated into each of the 17 universities' specific templates to fill out. The survey was reviewed by a panel of experts and directions, definitions, and the template were completed based on their feedback.

The survey instrument, in Appendix A, contained survey directions, IPEDS variable definitions, a sample completed survey for the case study university, and two questions for each of three years of data with the IPEDS starting point data already filled

in. The first survey question for each fiscal year was for universities to subtract any state appropriations in their IPEDS data not directly related to core teaching or university overhead. Examples such as, Agricultural Experiment Station, Cooperative Extension Service, medical school, Animal Research and Diagnostic Lab were listed for respondents to record the amounts of these non-core teaching or university overhead missions. Additional spaces were included for universities to enter other state appropriations not directly related to core teaching and university overhead.

The second question in each fiscal year's survey was for universities to subtract any non-resident or non-state support students. Examples included all FTE (both resident and non-resident) taking non-state supported courses, all non-resident FTE on state supported courses, medical school students and other non-resident and non-state support students. Additional spaces were provided for other non-resident and non-state supported students.

The surveys were then e-mailed with at least two follow-up emails and two phone calls, with requests for the data. Of the seventeen universities selected, eight completed and returned the survey for a response rate of 47%.

Differential Pricing in Higher Education

This study focuses on a single research institution with 39 different instructional units. These instructional units were the unit of analysis. The intent was to develop a methodology based on the theoretical framework to test first, if in the face of decreasing state support, the university was pricing education more like a for-profit firm. In order to test this, a time series of state general fund compared to student support for a single university will be graphed against the number of programs with discipline fees. The result

will test if this university's trend aligns with the statements in the literature review stating: universities are increasing the use of differential tuition in the face of reductions in state support (Nelson 2008; Strange 2015).

The second portion of the analysis on differential pricing in higher education will focus on testing if the theories of cost-based pricing and marginal utility, specifically consumer surplus, explain the differential pricing structures in higher education. In order to operationalize the concept of cost-based pricing, we will use data from the Delaware Cost Study and the conceptual framework described in Chapter 2 of this dissertation under the heading *Conceptual Model for the Instructional Equity Analysis*. Based on this conceptual model, we will extract for each of the 39 instructional units an instructional cost per credit hour based on their peers. This will serve as one of our independent variables in order to test the significance of cost-based pricing on differential tuition.

The other independent variable in our regression analysis is consumer surplus. As discussed in Chapter 2 under the heading *Theoretical Framework for Price Differentials*, consumer surplus will be different for each individual based on preference, ability, and financial return. In order to operationalize this concept, we will focus on the financial return portion of consumer surplus. We will use the median salaries for alumni with degrees in this major with zero to five years of experience from PayScale.com (2017); for purposes of this study, we will refer to these data as starting salary. Using this data, we were able to find relative matches for 32 out of the 39 instructional units. Finally, any units that are funded within the university as self-supporting, that is, without a subsidy of state-support dollars, will be eliminated from the model. The reason is that this outlier would be expected to have a significantly higher differential price than all other

instructional units did, as all other units are subsidized by state support dollars. There was only one unit structured without state support. Removing this outlier, our final group is 31 instructional units for Fiscal Year 2015. Fiscal Year 2014 had 29 observations as cost data for two of the instructional units were not available for Fiscal Year 2014.

The dependent variable in our regression is differential tuition. To operationalize this variable, we found the price of each of these programs using the university's board of regents' website. We used FY15 pricing data for the analysis, as our starting salary data was for 2016-2017. Therefore, FY15 would have been the last full year of prices prior to entering the workforce in 2016.

The regression analysis tested here will take the form of Equation 1. Where y_i represents the price charge per student credit hour in a discipline i, x_{1i} represent the cost of discipline i, x_{2i} represent the expected starting salary of discipline i, and e_i represents the random component of price per student credit hour.

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + e_i \quad (1)$$

In addition to running Equation 1, for the starting salary of a discipline, Equation 2 will be run where y_i represents the price charged per student credit hour in a discipline i, x_{1i} represent the cost of discipline i, x_{2i} represent the expected median mid-career salary of discipline i, and e_i represents the random component of price per student credit hour. In this case, β_1 measures the change in price per student credit hour, given a one-unit change in the cost of instruction. Similarly, β_2 measures the change in price per student credit hour given a one-unit change in the expected mid-career salary.

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + e_i \quad (2)$$

Analytic Method

In order to analyze research question #3, in the face of decreasing state support, are public universities pricing education more like a for profit firm?, we will use descriptive statistics to see if the university is using more cost-based pricing, like a for-profit firm, as state support decreases. In order to analyze this state funding as a percentage of the university's overall budget, it will be graphed against the number of instructional units using program fees for the 15 years from 2002-2003 through 2016-2017.

To analyze research question #4, do the theories of cost-based pricing and marginal utility, specifically consumer surplus, explain the differential tuition pricing structures in higher education?, we will run a regression analysis to determine if a relationship existed between the dependent variable, price, and the independent variables: cost of instruction and starting salary. The regression analysis tested here will take the form of Equation 1. Where y_i represents the price charged per student credit hour in a discipline i, x_{1i} represent the cost of discipline i, x_{2i} represent the expected starting salary of discipline i, and e_i represents the random component of price per student credit hour.

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + e_i \quad (1)$$

In interpreting the results of the equation, a two-tail p value will be determined to be significant at the 95% confidence level for each variable and the model. In addition, the coefficient β will be used to identify the change in the dependent variable for each

one-unit change in the independent variable. Finally, R^2 statistical measure will tell us how well our independent variables predict the change in the dependent variable, price.

A regression analysis of Equation 2 will also be run and the same test and interpretations described will be used. Following that analysis, we will compare the results of Equation 2 to Equation 1 to see if either of them more accurately predicts the price.

The data used in the regression equations presented help us to avoid reverse causality. In Equations 1 and 2 we use the Delaware Costs Study instructional costs of the selected peers. By using peer instructional costs as opposed to the case study institution's expenditure data, we avoid reverse causality. One can see how using the case institution's expenditure data could cause concerns of reverse causality. If we had used the case institution's expenditures, it could be argued that as the university increased its differential tuition for a specific program that increase in price resulted in that unit increasing its expenditures because of the additional revenue. In our model, though, it would be difficult for us to argue that the price at our case study university caused an increase in expenditures of selected peers, with locations spanning across the country. As a result, we suggest that our $x_{1,i}$ variable, peer cost of instruction, affects our case study institution's price, and not the other way around, allowing us to avoid reverse causality.

A similar argument can be made with our $x_{2,i}$ variable, starting salary (or, in the case of Equation 2, mid-career salary). If we had used the starting salary of students from the case study institution, there could be an argument that the price of the program at the case university affected the quality of education (either positively or negatively) and therefore affected the starting salary. In our analysis, we used national data from

PayScale.com; as a result, we are confident that the tuition price of a specific program at the case university does not affect the starting salary of individuals throughout the country with that major. Therefore, we believe our second variable is also not suspect to reverse causality.

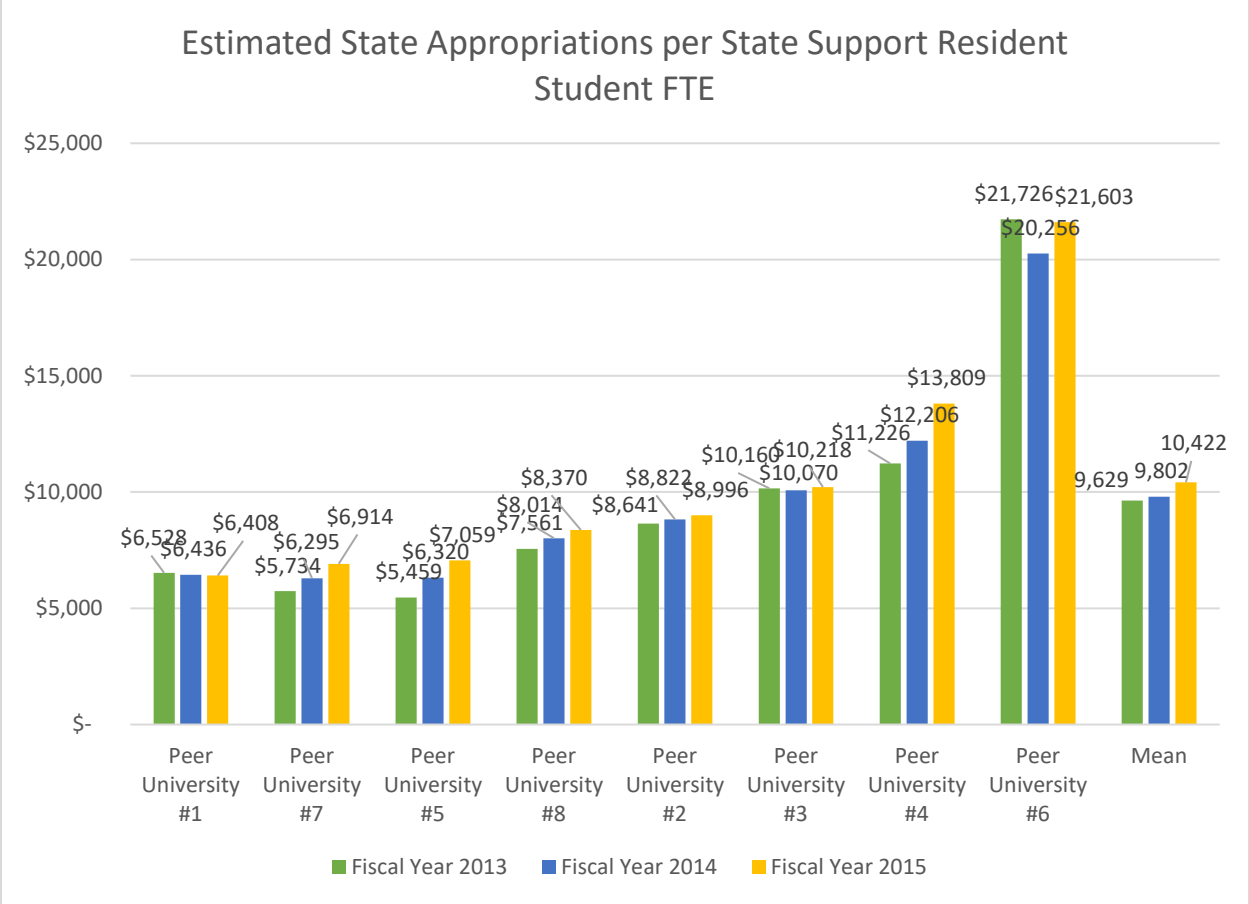
FINDINGS

This chapter will provide the results of the analyses described in the methodology section. It will provide and analyze the results from the state funding per resident student FTE findings. Additionally, it will include descriptive statistics comparing state general funding to the implementation of differential tuition for our case study. Finally, it will provide and analyze the output from the regression model and the associated descriptive statistics. Section one will focus on how state funding per resident student FTE varies between peer institutions (Research Question 1), and if state funding trends from year to year are similar for all peer institution, and if variations exist in a given year by institution (Research Question 2). Section two will focus on analyzing, in the face of decreasing state support, whether public universities are pricing education more like a for-profit firm (Research Question 3). Section two will then provide the regression analysis examining whether the theories of cost-based pricing and marginal utility, specifically consumer surplus, explain the differential tuition pricing structures in higher education (Research Question 4).

State Support per Resident Student FTE

The survey on state support per resident student FTE yielded eight results from our survey of seventeen peer institution. Research Question #1 set out to find how state funding per resident student FTE varies between peer institutions. Our survey design aimed to gather comparable data that may be lacking in other surveys by gathering state funds for core teaching and university overhead and dividing that by the resident state support student FTE (See figure 4).

Figure 1. Estimated State Appropriations per State Support Resident Student FTE



The Fiscal Year 2013 funding per state support resident student FTE ranged from $5,459 for Peer University #5 to $21,726 for Peer University #6. The mean was $9,629 and the median value was $8,101 per state support resident student FTE.

The Fiscal Year 2014 funding per state support resident student FTE ranged from $6,295 for Peer University #7 to $20,256 for Peer University #6. The mean was $9,802 and the median value was $8,418 per state support resident student FTE.

The Fiscal Year 2015 funding per state support resident student FTE ranged from $6,408 for Peer University #1 to $21,603 for Peer University #6. The mean was $10,422 and the median value was $8,683 per state support resident student FTE.

In response to the research question of how does state funding per resident student FTE vary between peer institution, our findings would suggest that there is a wide variation in funding per resident FTE. The university with the largest funding per resident student FTE reported nearly four times the funding per resident student FTE as the university that reported the least funding per resident student FTE. Similarly, the second and third university with the largest funding per resident student FTE are nearly double the funding per FTE of the three universities with the least funding per resident student FTE.

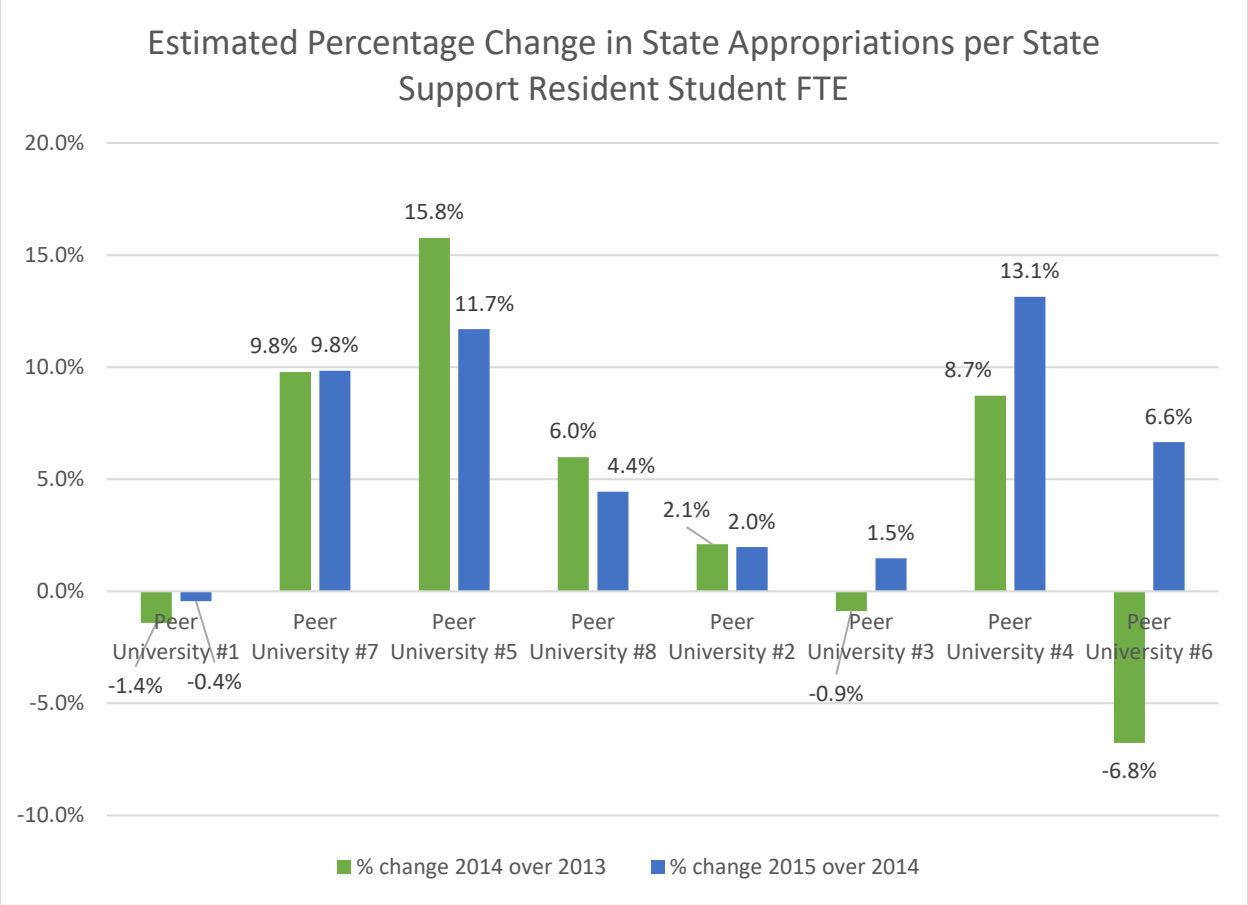
We will go into the discussion of these data in more depth in our final chapter, but it important to note what these finding are saying (and not saying). These findings do not reflect the total resources of core teaching and university overhead, as the non-resident mix at these schools may vary, thus providing additional funding for the university as non-residents typically pay a larger tuition rate compared to residents. Since both the state appropriations and the resident student FTE are moving from year to year, increases or decreases in the state appropriations per state support resident student FTE cannot be assumed to track with nominal increases or decreases in state funding. If states tied funding to the number of resident student FTE, these assumptions could be made; but since we have not analyzed the distribution mechanism for each of these universities, that assumption could not be made.

What these findings do test are the levels that states invest in their resident state support students. These findings show that states invest in their resident students at very different levels. While these results do not estimate the whole financial picture of these universities, since state appropriations are the base of a state support institution, these

results suggest that these universities have very different starting points for their financial base.

The second research question asked if state funding trends from year to year are similar for all peer institution, or if variations exist in a given year by institution (See Figure 2).

Figure 2. Estimated Percentage Change in State Appropriations per State Support Resident Student FTE



The percentage change in state appropriations per state support resident student FTE for fiscal year 2014 varies from a decrease of 6.8% for Peer University #6 to an increase of 15.8% for Peer University #5. The mean change was a positive 4.2% and the median value was 4.0%.

The percentage change in state appropriations per state support resident student FTE for fiscal year 2015 varies from a decrease of 0.4% for Peer University #1 to an increase of 13.1% for Peer University #4. The mean change was a positive 6.1% and the median value was 5.5%.

Therefore, the data show that the state funding trends in our limited sample vary greatly by institution for a given year. In fiscal year 2014, three institution had state appropriations per resident student FTE of greater than 6.0%, while two institutions had growth between 0.0% and 6.0%, and the remaining three institutions experienced decreases between 0.9% and 6.8%.

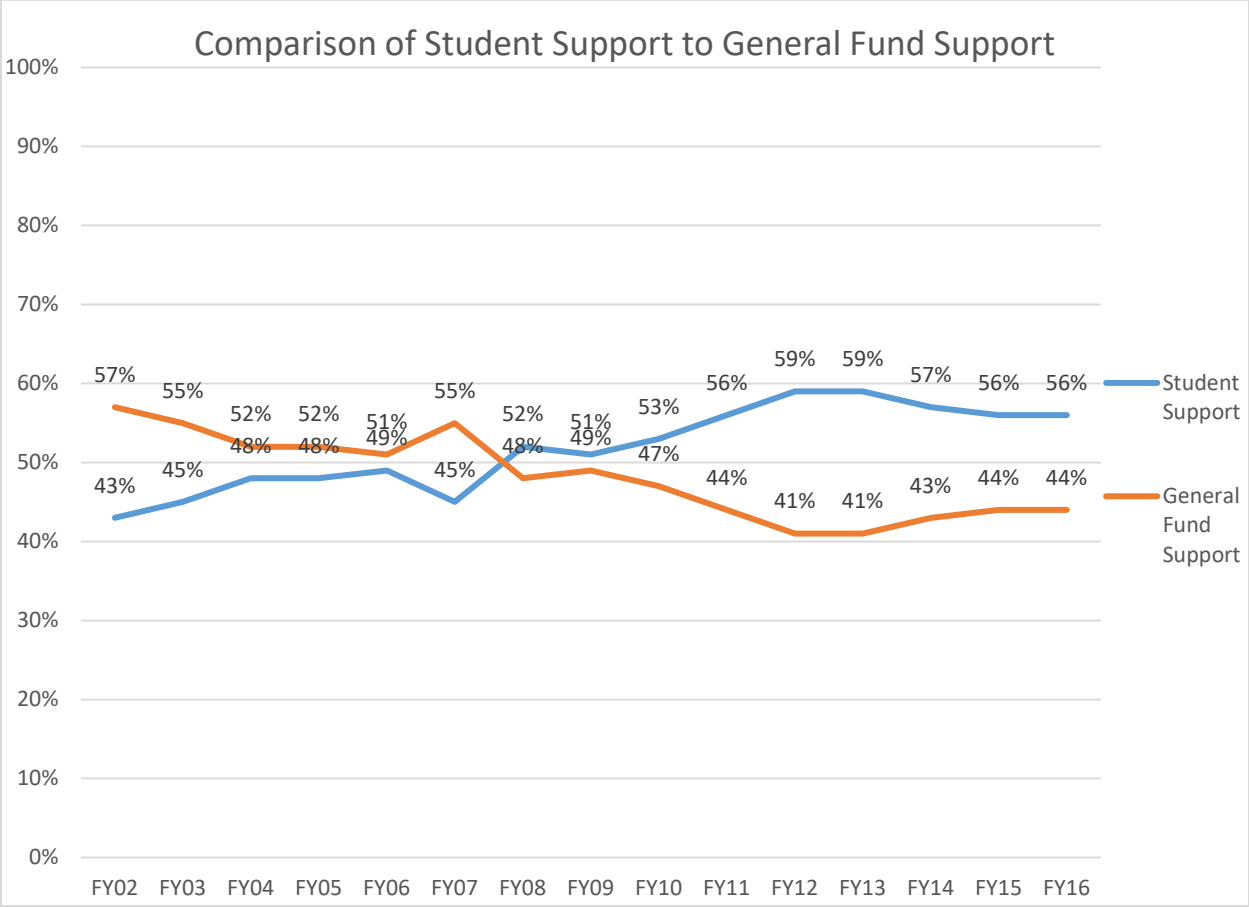
In fiscal year 2015, four institutions had state appropriations per resident student FTE of greater than 6.0%, while three institution had growth between 0.0% and 6.0%, and the one remaining institution experienced a decrease of 0.4%. The funding variations in fiscal year 2014 and 2015 from our survey would suggest that a signification amount of variation in state funding per resident student FTE exists by institution for a given year. Even in fiscal year 2015, in which all but one of the universities experienced an increase in state funding per resident student FTE, the funding growth experienced by each institution varied greatly.

State General Funding Trends Compared to the Implementation of Differential Tuition

Research question three set out to test if our case study aligned with the statements in existing literature that universities were increasingly using state support tuition in the face of decreasing state general funds (Nelson 2008). In order to analyze this, we looked at 15 years of data, Fiscal Year 2002 to Fiscal Year 2016, to compare the percentage of general fund support for higher education versus the implementation of programs with differential tuition.

First, we analyzed the trend of state general funds for the state in which the case study took place, as one can see in Figure 3; over this 15-year period, the funding from state support decreased from 57% to 44%, while the funding from student support increased from 43% to 56% (Data from Case Study Institution). This trend is consistent with the literature review of state funding trends in the U.S.

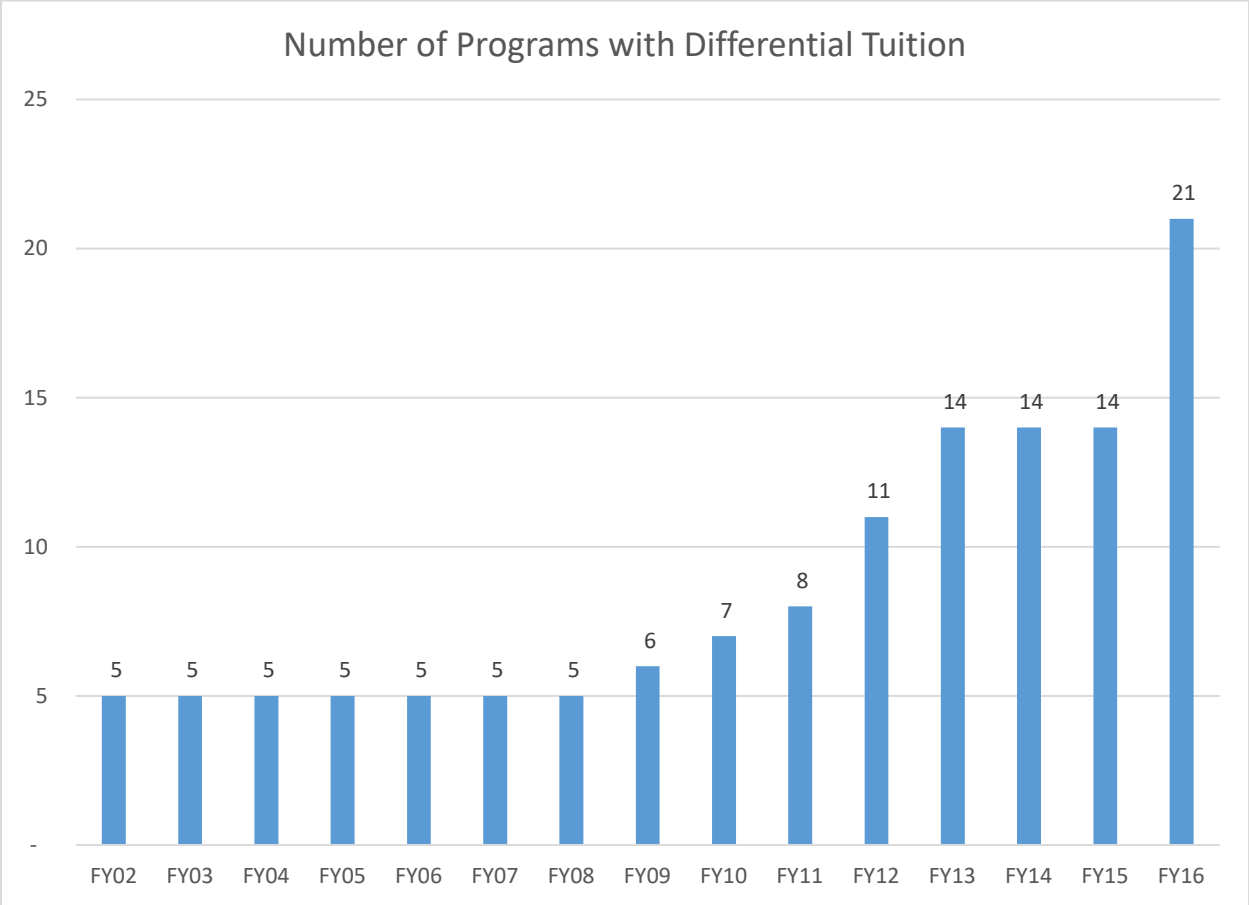
Figure 3. Comparison of Student Support to General Fund Support



For the same time period, we then analyzed the number of undergraduate programs with differential tuition (Data from Case Study Institution). This data also followed the trend in the literature review suggesting that the use of differential tuition has been increasing. The number of programs with differential tuition increased from 5 in Fiscal Year 2002 to 21 in Fiscal Year 2016, as can be seen in Figure 4. In addition, the

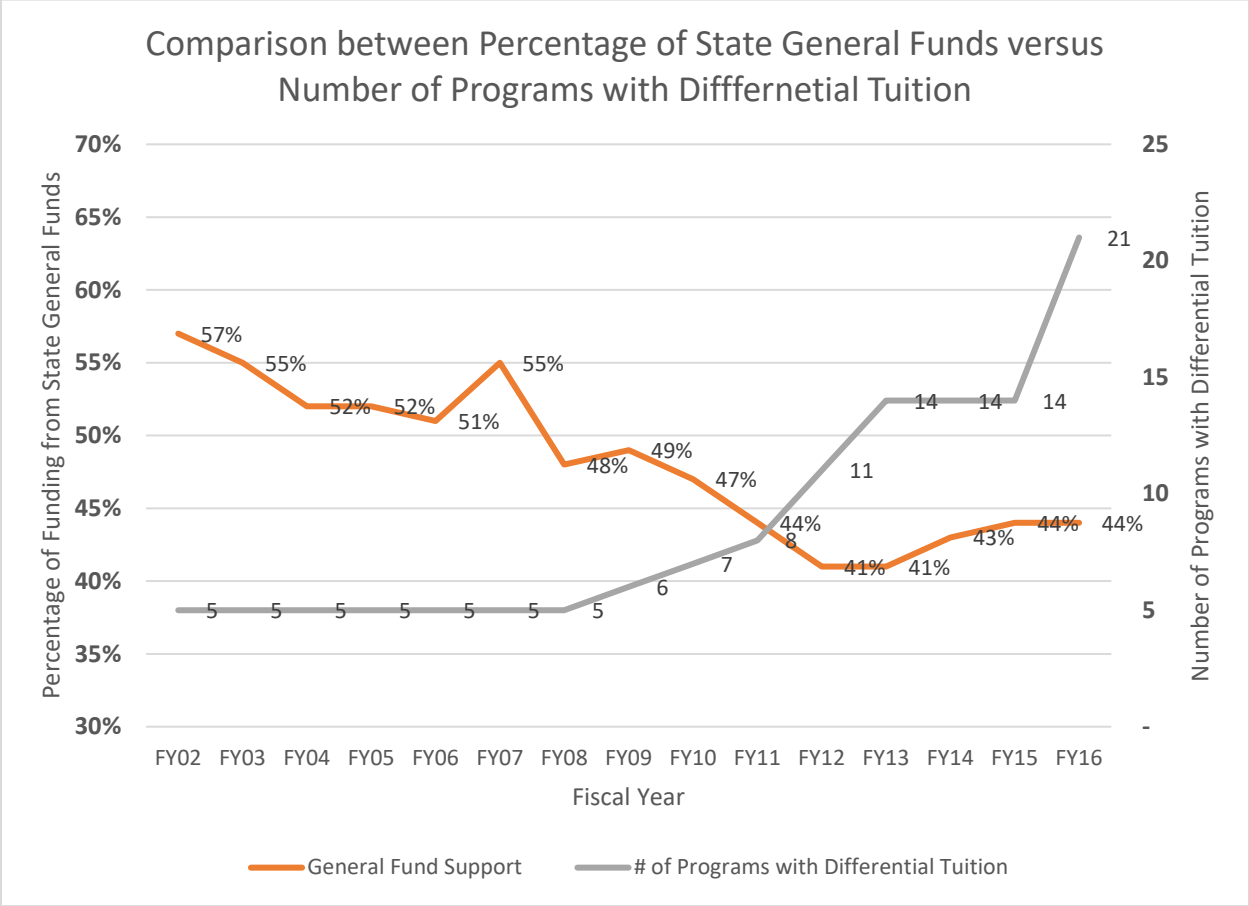
average amount of the program fee grew from $24.25 to $75.24 over the time period, resulting in an increase of 310%, as opposed to the increase in tuition which rose from $106.06 to $238.50, resulting in an increase of 225%.

Figure 4. Number of Programs with Differential Tuition



Finally, comparing the percentage of state general funds to the number of programs with differential tuition, one can confidently say that the long-term trend shows an inverse relationship; see Figure 5, suggesting that this case study supports the previous literature (Nelson 2008), indicating that as state funding decreases, universities use differential tuition.

Figure 5. Comparison between Percentage of State General Funds versus Number of Programs with Differential Tuition



Differential Tuition Pricing Drivers

Starting Salary

Research question four set out to test if the theories of cost-based pricing and marginal utility, specifically consumer surplus, explain the differential tuition pricing in higher education. The operationalization of the cost-based pricing was done using the Delaware Cost Study database, as described earlier. For the first regression, the consumer surplus was operationalized using the starting salary (PayScale.com 2017). The regression formula took the form:

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + e_i \quad (1)$$

Where y_i represents the price charged per student credit hour in a discipline i, x_{1i} represent the cost of discipline i, x_{2i} represent the expected starting salary of discipline i, and e_i represents the random component of price per student credit hour.

Using this regression with fiscal year 2015 data, the intercept and starting salary were found to be significant with p-values of <.0001. Cost of instruction was also found to be significant with a p-value of .0036. The β coefficients for the regression were 109.989 for the intercept, 0.102 for the cost of instruction, and 2.449 for the starting salary. Resulting in Equation 7:

$$y_i = 109.989 + 0.102 x_{1,i} + 2.449 x_{2,i} + e_i \quad (7)$$

The results of the regression suggest that for each dollar increase in the cost of instruction, price would be expected to increase by $0.102, and for each thousand dollar increase in starting salary, the price would be expected to increase by $2.449, with an intercept of $109.989. The R^2 statistical measure for this regression was 0.774, suggesting that 77.4% of the variation in price can be explained by our equation.

In order to test for autocorrelation in the residuals, a Durbin-Watson statistic was calculated. With our sample, the critical values for the Durbin-Watson Statistic with a significance level of .05 are a lower bound (d_U) of 1.6 and an upper bound (4- d_U) of 2.4. Therefore, since our test statistic of 1.9 falls within the range of d_U and 4-d_U, we can reject the null hypotheses of no positive and no negative autocorrelation at the 5 percent significance level (Gujarati & Porter 2009).

We then repeated this analysis with early career data for fiscal year 2014. This analysis had 29 observations. Using this regression with fiscal year 2014 data the

intercept and starting salary were found to be significant with p-values of <.0001. Cost of instruction was also found to be significant with a p-value of .0009. The β coefficients for the regression were 121.407 for the intercept, 0.148 for the cost of instruction, and 1.960 for the starting salary, resulting in Equation 8:

$$y_i = 121.407 + 0.148x_{1,i} + 1.960x_{2,i} + e_i \quad (8)$$

The results of the regression suggest that for each dollar increase in the cost of instruction, price would be expected to increase by $0.148, and for each thousand dollar increase in starting salary, the price would be expected to increase by $1.960, with an intercept of $121.407. The R^2 statistical measure for this regression was 0.803, suggesting that 80.3% of the variation in price can be explained by our equation.

In order to test for autocorrelation in the residuals, a Durbin-Watson statistic was calculated. With our sample, the critical values for the Durbin-Watson Statistic with a significance level of .05 are a lower bound (d_U) of 1.6 and an upper bound (4- d_U) of 2.4. Therefore, since our test statistic of 1.6 falls within the range of d_U and 4-d_U, we can reject the null hypotheses of no positive and no negative autocorrelation at the 5 percent significance level (Gujarati & Porter 2009).

Mid-Career Salary

For the next regression, the consumer surplus was operationalization using the mid-career salary (PayScale.com 2017). The regression formula took the form:

$$y_i = \beta_0 + \beta_1 x_{1,i} + \beta_2 x_{2,i} + e_i \quad (2)$$

Where y_i represents the price charged per student credit hour in a discipline$i$, x_{1i} represent the cost of discipline i, x_{2i} represent the expected mid-career salary of discipline i, and e_i represents the random component of price per student credit hour.

Using fiscal year 2015 data, this regression the intercept, cost of instruction, and mid-career salary were found to be significant with p-values of <.0001. The β coefficients for the regression were 131.395 for the intercept, 0.162 for the cost of instruction, and 0.973 for the mid-career salary, resulting in Equation 9:

$$y_i = 131.395 + 0.162x_{1,i} + 0.973x_{2,i} + e_i \quad (9)$$

The results of the regression suggest that for each dollar increase in the cost of instruction, price would be expected to increase by $0.162, and for each thousand-dollar increase in mid-career salary, the price would be expected to increase by $0.973, with an intercept of $131.395. The R^2 statistical measure for this regression was 0.669, suggesting that 66.9% of the variation in price can be explained by our equation.

In order to test for autocorrelation in the residuals, a Durbin-Watson statistic was calculated. With our sample, the critical values for the Durbin-Watson Statistic with a significance level of .05 are a lower bound (d_U) of 1.6 and an upper bound (4- d_U) of 2.4. Therefore, since our test statistic of 2.2 falls within the range of d_U and 4-d_U, we can reject the null hypotheses of no positive and no negative autocorrelation at the 5 percent significance level (Gujarati & Porter 2009).

We then repeated the analysis using fiscal year 2014 data; in this regression, the intercept and cost of instruction were found to be significant with p-values of <.0001. The mid-career salary was also found to be significant at the .0009 level. The β coefficients for the regression were 137.29 for the intercept, 0.218 for the cost of instruction, and 0.722 for the mid-career salary, resulting in Equation 10:

$$y_i = 137.293 + 0.218x_{1,i} + 0.722x_{2,i} + e_i \quad (10)$$

The results of the regression suggest that for each dollar increase in the cost of instruction, price would be expected to increase by $0.218, and for each thousand-dollar increase in mid-career salary, the price would be expected to increase by $0.722, with an intercept of $137.293. The R^2 statistical measure for this regression was 0.758, suggesting that 75.8% of the variation in price can be explained by our equation.

In order to test for autocorrelation in the residuals, a Durbin-Watson statistic was calculated. With our sample, the critical values for the Durbin-Watson Statistic with a significance level of .05 are a lower bound (d_U) of 1.6 and an upper bound (4- d_U) of 2.4. Therefore, since our test statistic of 1.7 falls within the range of d_U and 4-d_U, we can reject the null hypotheses of no positive and no negative autocorrelation at the 5 percent significance level (Gujarati & Porter 2009).

Comparing the starting salary regression to the mid-career salary in both of our fiscal years, it appears, based on the R^2, that the starting salary regression might be a better predictor of price. This data would follow our hypothesis that as universities set their differential pricing based on consumer surplus theory, they focus on the starting salary of the major when pricing rather than focusing on the lifetime earnings, which would be better represented by the mid-career salary. This may suggest that students focus on the ability to pay off student loans upon graduation when calculating their consumer surplus, or that universities assume that students focus on the ability to pay off student loans upon graduation when calculating their consumer surplus. Regardless of whether it is the student's actual consumer surplus or the university's assumptions, it appears that pricing is more highly correlated with quick payoffs (starting salary) than

with the longer term, and possibly more accurate lifetime return on investment (mid-career salary).

DISCUSSION

This chapter contains four different sections. The first section provides a summary of the entire paper including the review of literature, methodology, and findings. The second sections reviews the conclusions based on the analysis. The third section contains a discussion based on the findings and the conclusions of the study. The last section of this chapter includes limitations, recommendations for practice, and recommendations for future research.

Summary

At the outset of this project our goal was to better understand who is paying for higher education and why. Understanding the current state of higher education funding is extremely important as the theoretical debate of how higher education should be funded continues to increase in intensity. The results from our analysis show that there is a large variation in state funding of higher education across peer institutions and that these funding differences greatly vary from year to year. These findings suggest that state economies and political forces have a large impact on higher education finance and, although it is important to understand the national trends, it is important for policy makers and researchers to also focus on individual states, as there are large structural variations as well as significantly different variation from year to year. This data will be useful to help keep the focus on individual state's decisions as well as to provide them with accurate benchmarking with other states and universities.

Additionally, to contribute to the knowledge of higher education funding, the pricing structure of a case study university was analyzed and explanatory theories and variables were developed and supported by regression analysis. These findings show that

as state support decreases universities are taking on pricing characteristics typically found in a for-profit firm. The findings supporting the theory that higher education is increasingly using cost-based pricing and identifying the programs with the highest projected consumer surplus are significant in many respects. First, these findings allow researchers and policy makers to analyze the pricing impact of continued decreases in state funding of higher education. Secondly, this information allows universities to analyze and compare their pricing methodology with that of the case study university.

The findings also add significant information to the discussion of disinvestment of certain majors; findings of this study would suggest that certain high cost programs with lower relative starting salaries are actually being subsidized more than high cost programs (such as some of the STEM fields) that have higher starting salaries. To describe this concept, consider two majors that have the same cost of instruction, $300 per credit hour, for example. Also, assume that one of these majors is a STEM field, which, all else equal, typically demands a higher starting salary than a humanities major. The findings in this analysis would suggest that the STEM major would have a larger differential tuition due to the higher starting salary. For this example, we will assume that base tuition for each of these majors covers $100 per credit hour of the instruction costs and the differential tuition on the STEM program is $50 per credit hour. Analyzing the how the $300 cost of instruction per credit hour for these two majors is funded shows that the STEM major is funded by $100 base tuition, $50 differential tuition, and $150 of state general funds (as state general funds is the only other source of instructional revenue). On the other hand, the humanities $300 cost of instruction per credit hour is funded by $100 base tuition, $0 differential tuition, and $200 of state support. As a result, the STEM

major would receive $150 of state support per credit, while the humanities major would receive $200 per credit hour of state support. This illustrates a numerical example of the findings from this research, which supports the statement that certain high cost programs with lower relative starting salaries are actually being subsidized more than high cost programs (such as some of the STEM fields) that have higher starting salaries.

Most importantly, this analysis can provide data that can help inform debates on how we could fund higher education, as this analysis provides us with a common understanding of how we are currently funding higher education. These debates will be extremely important and will shape the future of higher education in America.

Conclusions

The main conclusions from this analysis are that state support per resident state support student FTE varies greatly between institutions, meaning that the starting resource base for peer universities can be very different. In addition, variation from year to year can be significant, with some universities seeing decreases in state funding per resident FTE in the same years that others see significant increases. As for funding within the university, it was found that market forces and cost structures can account for instructional funding differences and, in our case study university, no groups of discipline areas were systematically inequitably funded. These findings were contrary to previous studies.

The study also found that decreases in state general funds are correlated with increases in the number of undergraduate programs charging differential tuition. Further, the analysis also found cost of instruction, early career salary, and mid-career salary for a given program were positively correlated with the price a university charges for that

program. These factors were also found to be very strong predictors of price. As a result of these conclusions, we suggest that the theories of cost-based pricing and marginal utility, specifically consumer surplus, can be used to explain pricing differentials in higher education.

Discussion

This study provides an analysis of equity in funding in higher education from a variety of perspectives. It includes a survey of peer institutions to analyze their state funding per resident state support student FTE and the variation in the percentage change across peer universities for a given year; it also provides a methodology for analyzing the equity of instructional resources distributions, and analyzes the revenue and pricing for our case study institution.

State Support per Resident Student FTE

In theory, states use general funds to support the higher education of the residents of that state. This theory can be seen in the tuition pricing structure in which non-residents pay a higher tuition rate than residents of the state. The difference between the two prices, in theory, could be thought of as the state general fund appropriations subsidizing the tuition of the resident, compared to the non-resident who bears the full cost of education.

Based on this theory, it would be important for university leaders and policy makers to have comparable data on how much each state is subsidizing its resident students compared to how much other states subsidize their resident students. Current data on this topic contains flaws, one flaw is gathering comparable state appropriations for the universities base mission, because the data includes Agricultural Experiment

Stations, Cooperative Extensions Services, medical schools, or any other non-core operation that is within the university that receives revenue from the state. The other flaws that exist in data sources relate to getting the resident state supported student FTE isolated. Analyzing all FTE includes non-residents who in theory are not subsidized by the state and who pay a higher tuition rate in most cases. The survey utilized in this study provides comparable data on state appropriations per resident state supported student FTE that can be used by policy makers and institutional leaders.

The results of this survey show a large variation in the state support per resident student FTE between universities. This finding suggests that universities have large differences in their base funding to execute their mission. These variations would be expected to have impacts on faculty to student ratios, pricing of both resident and non-resident tuition, and the use of differential pricing. Widening this study to more universities and over more years could help policy makers, university leadership, and researchers have a better understanding of the differences between universities and provide data for them to make data informed decisions.

The results of the survey also show a large variation in funding changes between universities for a given year. This data suggest that states are probably not funding universities based on the services provided to the resident students of that state. If that were the case, we would expect much less variation from year to year. Secondly, it suggests that in addition to national long-term trends on funding higher education, state short-term issues may have a very significant impact on public university funding. This hypothesis may not be overly surprising, as states try to balance their budgets using the “balancing wheel" between healthcare, safety, and education; each state’s political,

economic, and structural issues may be more influential than national trends on higher education (Hovey 1999; Kramer 2011, Tandberg 2010).

Equitable Distribution of Instructional Resources

In addition to analyzing the variables involved in pricing in higher education, this study also analyzed the distribution of instructional resources in higher education. The distribution of instructional resources in higher education currently has a brief body of literature behind it. Existing studies fail to take into account market forces and cost structures when analyzing the equitable distribution of instructional resources (Newfield 2009; Santos 2007; Volk et al. 2001). Our analysis includes data from the Delaware Cost Study in order to benchmark each department against its peers and then summarizes it at the college level to see if any specific discipline areas are systematically underfunded.

In contrast to previous studies, our analysis when taking into account market forces and cost structures did not find specific discipline areas that were inequitably funded. As a result in our case study university, although there were differences in funding, we found that market forces and cost structures did account for most of the instructional funding differences when compared to the previous literature. It is important to note that these finding are for the specific university studied compared to the national average; therefore, it does not and will not account for a national disinvestment in a given instructional unit. Instead, it addresses whether the distribution at this university was equitable when compared to national peers.

Pricing Structures in Higher Education

The pricing of higher education is an often-debated topic. Opinions on the topic are passionately argued, specifically when it comes to the private and public good

components of higher education, affordable access to higher education, and differential pricing of higher education.

The public versus private good of higher education continues to be a topic of discussion for higher education. The theory of the public good of higher education suggests that there are positive externalities that are enjoyed by those who did not directly pay for the education, for example, less crime as a result of increased education (Marginson 2007). On the private side of the argument, students who obtain a degree though higher education have the opportunities to secure superior incomes (Marginson 2007). While both of these theories are sound, the debate remains as to how much of higher education is a public good and how much is private. Importantly, as a result of these two types of goods, the question arises as to who should pay for higher education and what portion should be paid by the individuals and what portion paid by society.

The data analyzed in this study would suggest that higher education is being increasingly priced more as a private good. The research shows that funding of higher education has been decreasing and that an increasing amount of the burden is being paid by the student (American Academy of Arts and Science 2016a, 2016b; Feldman 2012; State Higher Education Executive Officers Association 2015; National Association of State Budget Officers 2014). In our case study, it can be seen that the general fund support decreased from 57% of the support to 44% (Data from Case Study Institution). In response to this change, the case study institution increased its number of programs with differential tuition from 5 to 21 over that period. These findings support previous literature suggesting that as state funding decreases, universities will use differential tuition at an increasing rate (Nelson 2008).

As noted earlier in this analysis, this behavior makes sense; as universities become less subsidized by the state they will increasingly take on characteristics of for-profit firms. While we suggest that they will take on some characteristics of these firms, it is important to note that we are not suggesting they will become for-profit firms, merely that they will take on some characteristics of these firms. One can think of this on the spectrum of not-for-profit entities; the entities that are extremely highly subsidized would be expected to price and behave differently than not-for-profit entities that received no subsidies. We are suggesting that, as state funding decreases, universities will behave more like the non-subsidized entities than the heavily subsidized entities and as a result we would expect them to increasingly take on characteristics of a for-profit firm, all else equal. One of these characteristics is cost-based pricing.

Cost-based pricing was used as one of the variables in our regression analysis used to understand the variables that make up a university's decision to charge differential tuition for undergraduate programs and the amount. As discussed, as universities see a decrease in state support funding they are increasing their use of differential tuition. Using the practices of a for-profit firm, they will begin to price their products differently as they move along the spectrum. In for-profit firms, if the cost of making a specific good is more than the price the firm is able to charge, one would expect the firm to stop making that product and instead focus its resources on the products that that it can produce at a cost less that the market clearing price they can charge. Therefore, as universities decide which undergraduate programs to charge differential tuition to, we would expect them to charge their high cost programs to defray the high costs of those programs as opposed to charging it to programs with low costs.

As universities receive less of their resources from the state and an increasing amount from students, we also suggest in our model that an individual's early career salary will be important. Our rationale for including this variable is the theory of marginal utility, specifically consumer surplus. Our reason for using this theory is focused on the analysis done by the price setters at the university. It is very important to understand how we are using this theory and also how we are not using this theory. We are suggesting that university price setters who are trying to increase revenues for the university, in light of reduced state funding, will try to increase revenues without losing students, as losing students would be counterproductive to their revenue stream. As these price setters assess which programs to raise price on, we suggest that they will try to estimate the consumer surplus for the students in each major. As many of the factors that go into consumer surplus are unknown to the price setter, they will simply focus on the general consumer surplus factors that apply to the majority of the students: the price of the degree and the expected financial return of the degree. As stated, there are far more factors that are involved in an individual's consumer surplus calculation, but price and financial return are the most applicable to all students. Of course, there are exceptions to these factors, such as an individual who is independently wealthy and does not include financial return in their calculation or an individual who wants a specific degree for the enjoyment of learning rather than financial return. But we suggest that the price setters cannot make sweeping assumptions based on these examples; therefore, we suggest they will use the information they have available regarding the factors that they believe to be applicable to the most students. We suggest that price setters will assume that price of degree and financial return on the degree are the two factors of consumer surplus that

they can analyze. As stated, it is important to note how we are not using this theory. We are not suggesting that all (or even most) students make their decisions based on financial return on a degree; we are simply saying these are the only factors on which price setters have readily available information.

Our regression analysis found both of these theories to be significant and the combination of these two theories had a very large explanatory power for the price of a degree. The fact that both of these theories are significant is interesting to analyze. Because cost of instruction is significant, universities are starting to price differently based on the cost of each "product," as we would expect. The second significant variable suggests that universities also look at the return on investment and price accordingly. Combining these two concepts would suggest that for two high cost programs, it would be conceivable that they could both cost the same to produce (in which case cost-based pricing if used alone would suggest that they would be priced similarly), but higher education price setters are willing to charge less for one of the degree programs simply because its majors are expected to make less in their early career. Using this simple example would suggest that higher education, in this case, is subsidizing the high cost programs with low early career salaries at a higher rate than high cost programs with higher early career salaries. This concept may contradict some who suggest that higher education is disinvesting in the humanities, which have been classified as high cost with lower income, and instead would suggest that higher education is maintaining the state subsidy of the humanities at the expense of STEM programs who on average have higher early career salaries. Of course, this is a single observation and further research would need to be done to support this finding.

Another finding from this study was that early career salary was a better predictor of price than mid-career salary. As discussed, we are suggesting that price setters are using the information available to set price and that our model may only reflect a small subset of the reasons students select certain majors. Combining these two ideas may suggest that price setters either: 1. Believe that students' consumer surplus is influenced more by early career salary than mid-career salary, or; 2. That price setters are more concerned with early career salary rather than mid-career salary. A rational choice argument could be made for either one of these ideas.

First, the price setters could believe that students are concerned more about the short term (early career salary), than the long term (mid-career salary). With an increased amount of the cost of education being paid by the students, there is an increase in the need for student loans. A rational choice argument could be made that the price setter would assume that the students are more short term motivated than long term because the repayment of student loans for these students will happen in the short term and not the long term.

Secondly, with the increased political scrutiny on student debt, a rational choice argument could be made that as the price setters are deciding which programs to apply differential tuition to, that they are aware and concerned with students' short term ability to pay back the debt. This could result in them acting in their own self-interest and trying to avoid putting additional debt on students who will have trouble paying the debt back in the short run. There are multiple reasons that price setters may be interested in the student's ability to pay back loans. First, there could be a general concern for the well-being of students, but beyond that, there are rational choice reasons for price setters to be

concerned. If students are not able to pay back their debt, it could result in negative publicity for the university. This negative publicity could have negative impacts on recruiting, as well as negative impacts on how the state views its investment in higher education, which could ultimately result in decreased state funding. Additionally, bad publicity could result in increased reporting and compliance rules, which increases the university's expenses.

Both of these theories could explain the rationale for price setters to focus on early career salary when assessing differential tuition. From a rational choice perspective, as shown here, there are sound explanations as to why early career salary is used when assessing differential tuition as opposed to mid-career salary. From a long term investment perspective, which is how we would characterize higher education investments, it is interesting though that the short run gains (early career salary) are used to price the product instead of long run gains (mid-career salary). As far as lifetime return on an educational investment, mid-career salary probably better represents an individual's return on investment. The reason mid-career salary is probably a better representation of return on investment is because most careers are significantly longer than the 0-5 years represented by the early career data. The focus on early career salary when pricing differential tuition would be good news to those majors who over the course of a career close the gap that exists in starting salaries, as they benefit from the lifetime earnings but pay a lower differential tuition price, all else equal.

Limitations

As this study is a case study, it will be limited by being a single observation; therefore, findings from this analysis cannot be automatically be expected to be true for

other research universities. Additionally, peer cost data are dependent on the survey information returned to the Delaware Cost Study and PayScale.com and is susceptible to any bias included in their survey methodology.

The Delaware Cost Study has nearly 200 participants. Although this is a substantial number of institutions, it is far from a comprehensive list of all institutions in the United States. Because of the incomplete list of institutions, some departments may have had difficulties finding peer institutions that they felt matched their specific instructional design characteristics. Even though matching CIP codes may have been found, the impact of imperfect peers may have resulted in less than optimal peer cost estimates.

In addition to the incomplete list of institutions, estimations of comparable peers are selected without knowledge of such factors as faculty rank distribution at selected institutions compared to the case study institution. If a specific department had, for example, a disproportionate number of full professors than their group of peers, this could result in a less than optimal cost estimate. While these issues exist, we believe their impact does not reduce the overall credibility of the analysis, nor do we know of a superior methodology available.

The state funding survey had a response rate of 47%, which is a limiting factor. In addition, the survey data is dependent on the accuracy of respondents' data. Finally, this survey was completed for a peer group of research universities and the results may or may not be able to be assumed for other groups of universities.

Recommendations for Practice

This analysis will be usefully to researchers, policy makers, and practitioners. Researchers will be able to use this analysis to provide a baseline for how universities price their majors and then in concert with policy makers, can debate if this is how institutions "should" be pricing higher education, as well as look at the possible impacts to students if this trend continues. Practitioners will be able to use this analysis to see if the same drivers explain their pricing structures, or if there are other explanatory variables that they think "should" or "are" driving pricing structures. All groups will be able to use the equity analysis between departments to look for true inequities in funding because of race, class, and gender. In addition, they will be able to have discussions on their campus to see if their funding matches up with their mission, or if there are inequities that they did not know existed.

Finally, policy makers, institutional leaders, and researchers can use the state funding per resident state supported student FTE to better understand their current level of state support and to debate if funding per resident state supported student FTE is an equitable way of distributing state resources. Currently, there are a variety of ways that states fund higher education, including performance-based models, formula funding models, and incremental budgeting models, for example. Funding based on student FTE would be more of a voucher type model, aligning students' choices in schools with the state support funding distribution. It would also align the costs of additional students with the resources needed to educate them. A model such as this would provide stability of funding for universities as well as an increased financial incentive to educate their state's residents. This is in contrast with current structures that may financially incentivize the

recruitment of higher tuition non-residents over a state's own residents, because funding is not directly tied to resident student FTE.

Recommendations for Further Study

This study found that cost-based pricing and consumer surplus could explain a great deal of an undergraduate program's differential pricing for the case study university. Future research should be done to see if the pricing theories found in this paper are found to be significant at other universities. It would also be useful for future qualitative research to be done to see if price setters are actually thinking about the theories described in this study when they are setting prices, or if the complex political and analytical job of setting prices can simply be described by these two theories, but is not intentionally done using these theories.

It is interesting to see that departmental units are equitably funded, even though some high cost programs that have low starting incomes have not been charged a program fee (essentially meaning that other units are subsidizing these high cost programs), further research should be done to consider the amount of this subsidy and how it compares to other literature on the disinvestment of certain disciplines. Additionally, future research should look at state funding per resident FTE and its relationship to undergraduate differential tuition, to see if universities with higher state funding per resident FTE charge fewer undergraduate programs differential tuition. These findings could either support or contradict our findings that as state subsidies decrease the use of differential tuition will increase.

Finally, it would be interesting to repeat this study for non-state subsidized non-profit universities. It would be interesting to see if they follow a similar pricing structure

as is found here, specifically, if their endowments act as state general funds do in our analysis, where if endowments as a percentage of educational costs decrease over time if the university increasingly uses differential tuition. A similar analysis could be done to see if universities with large endowments are able to charge fewer undergraduate differential tuition fees than universities with comparatively smaller endowments.

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APPENDIX A

Survey Instrument

Survey Directions

Thank you for your willingness to fill out the South Dakota State University's State Appropriations per State Support Resident Student FTE Survey. If you have any questions while filling out this survey please feel free to contact Mike Holbeck via e-mail at Michael.Holbeck@sdstate.edu or by phone (605-688-4455).

Your Survey will have 6 tabs. The first tab includes these directions. The second tab includes IPEDS Variable Definitions that were used to get the starting point for your "Fiscal Year 2013 State Appropriations" and "Fall 2012 Full-time Equivalent (FTE) Enrollment". The third tab is the completed example for fiscal year 2013 for South Dakota State University. Tabs 4-6 are the survey templates for you to input your data. Each tab is broken down into three sections, Net State Appropriations for Core Teaching and University Overhead, State Support Resident Student Full-Time Equivalent, Estimated State Appropriations per State Support Resident Student Full-Time Equivalent. The steps below provide instructions for filling out each section.

Step #1: Fill out the Net State Appropriations for Core Teaching and University Overhead Section

Purpose: The purpose of this section is to generate the net state appropriations for core teaching and overhead, this is done to generate comparable state appropriations across universities (for example, it would not be reasonable to include state appropriations for one universities Agricultural Experiment Station when dividing by the state support student FTE and compare it to a university which does not have an Agricultural Experiment Station). A comparable state appropriations is generated by reducing the IPEDS state appropriations (which is provided for fiscal year 2013) by those allocations that are not related to the core teaching and university overhead. Examples of state appropriations not related to core teaching and university overhead for South Dakota State University are: Agricultural Experiment Station, Cooperative Extension Service, and the Animal Research and Diagnostic Lab. Other examples could include medical schools or other programs not directly related to the core teaching or university overhead.

Directions: Please fill out all orange highlighted cells. If additional rows are needed for State Appropriations not directly related to core teaching and university overhead, they can be inserted above the two additional lines provided.

Formula: Fiscal Year State Appropriations – Total State Appropriation not directly related to Core Teaching or University Overhead = Net State Appropriations for Core Teaching and University Overhead

Step #2: Fill out the State Support Resident Student Full-Time Equivalent Section

Purpose: The purpose of this section is to generate the net state support resident student full-time equivalent estimate, this is done to generate comparable state support resident student full-time equivalent data. Our analysis assumes that the major use of state appropriations is to subsidize resident students' education, thus the reason non-resident students typically pay a higher (unsubsidized) price. A comparable state support resident student full-time equivalent estimate* is generate by taking the IPEDS Fall Full-Time Equivalent (which is provided for Fall 2012) and reducing it by those student FTE

that are not considered to be supported with state appropriations. Examples of student FTE that are not considered to be supported with state appropriations for South Dakota State University are: All FTE taking Non-State Supported Courses (for South Dakota State University courses at off-campus locations not considered to be state supported) and All Non-Resident FTE on State Support Courses. In addition, if programs such as medical schools are removed from the state appropriations above, the corresponding student FTE should also be removed from this section.

*Note: we use the term "estimate" because the IPEDS data source we start with estimates part-time enrollments using a formula.

Directions: Please fill out all orange highlighted cells. If additional rows are needed for Other Non-Resident or Non-State Support Students, they can be inserted above the additional line provided.

Formula: Fall Full-time Equivalent (FTE) Enrollment – Total Non-Resident and Non-State Support Students = Net State Support Resident Student Full-Time Equivalent Estimate

Step #3: The Estimated State Appropriations per State Support Resident Student Full-Time Equivalent will calculate itself

Purpose: The purpose of this section is to calculate the Estimated State Appropriations per State Support Resident Student FTE, using the data provided above.

Directions: No action needed.

Formula: Net State Appropriations for Core Teaching and University Overhead / Net State Support Resident Student Full-Time Equivalent Estimate = Estimated State Appropriations per State Support Resident Student FTE

IPEDS Variable Definitions

State Appropriations

Variable Description

State appropriations are amounts received by the institution through acts of a state legislative body, except grants and contracts and capital appropriations. Funds reported in this category are for meeting current operating expenses, not for specific projects or programs.

Variable Sources

IPEDS, Spring 2014, Finance component

Full-time Equivalent

Variable Description

Full-time equivalent enrollment: This variable is derived from the enrollment by race/ethnicity section of the fall enrollment survey. The full-time equivalent of the institution's part-time enrollment is estimated and then added to the full-time enrollment of the institution. This formula has been used to produce the full-time equivalent enrollment that is published annually in the Digest of Education Statistics. The full-time equivalent of part-time enrollment is estimated by multiplying the part-time enrollment by factors that vary by control and level of institution and level of student. The following factors were used:

Part-time undergraduate enrollment (line 22)
Public 4-year .403543
Not-for-profit and for-profit, 4-year .392857
Public 2-year and <2year .335737
All other sectors .397058
First professional (line 23)
Public 4-year .600000
Not-for-profit and for-profit, 4-year .545454
Graduate (line 25)
Public 4-year .361702
Not-for-profit and for-profit, 4-year .382059

These factors were estimated using reported full-time equivalent of part-time enrollments from enrollment data collected in the Higher Education General Information System (HEGIS) 1967-1986.

Variable Sources
Derived - IPEDS, Spring 2014, Fall Enrollment component
IPEDs Website: http://nces.ed.gov/ipeds/datacenter/Default.aspx

Example of Completed University

Net State Appropriations for Core Teaching and University Overhead

Description		Amount
Fiscal Year 2013 State Appropriations (Source: IPEDS)		$ 60,000,000
less State Appropriation not directly related to Core Teaching or University Overhead:		
Agricultural Experiment Station	8,000,000	
Cooperative Extension Service	9,000,000	
Medical School	-	
Animal Research and Diagnostic Lab	-	
Enter other State Appropriations not directly related to core teaching and university overhead #1		
Enter other State Appropriations not directly related to core teaching and university overhead #2		
Total State Appropriation not directly related to Core Teaching or University Overhead		17,000,000
Net State Appropriations for Core Teaching and University Overhead		**$ 43,000,000**

State Support Resident Student Full-Time Equivalent

Description		FTE Estimate
Fall 2012 Full-time Equivalent (FTE) Enrollment (Source: IPEDS)		11,000
less Non-Resident and Non-State Support Students:		
All FTE (both Resident and Non-Resident) taking Non-State Supported Courses		
All Non-Resident FTE on State Supported Courses	3,000	
Medical School Students		
Other Non-Resident or Non-State Support Students		
Total Non-Resident and Non-State Support Students		3,000
Net State Support Resident Student Full-Time Equivalent Estimate		**8,000**

Estimated State Appropriations per State Support Resident Student Full-Time Equivalent

Net State Appropriations for Core Teaching and University Overhead		$ 43,000,000
Net State Support Resident Student Full-Time Equivalent Estimate		8,000
Estimated State Appropriations per State Support Resident Student FTE		**$ 5,375**

Sample University Fiscal Year 2013 (please fill out all highlighted cells)		
Net State Appropriations for Core Teaching and University Overhead		
Description		**Amount**
Fiscal Year 2013 State Appropriations (Source: IPEDS)		$ 50,000,000
less State Appropriation not directly related to Core Teaching or University Overhead:		
Agricultural Experiment Station		
Cooperative Extension Service		
Medical School		
Animal Research and Diagnostic Lab		
Enter other State Appropriations not directly related to core teaching and university overhead #1		
Enter other State Appropriations not directly related to core teaching and university overhead #2		
Total State Appropriation not directly related to Core Teaching or University Overhead		-
Net State Appropriations for Core Teaching and University Overhead		**$ 50,000,000**
State Support Resident Student Full-Time Equivalent		
Description		**FTE Estimate**
Fall 2012 Full-time Equivalent (FTE) Enrollment (Source: IPEDS)		70,000
less Non-Resident and Non-State Support Students:		
All FTE (both Resident and Non-Resident) taking Non-State Supported Courses		
All Non-Resident FTE on State Supported Courses		
Medical School Students		
Other Non-Resident and Non-State Support Students		
Total Non-Resident and Non-State Support Students		-
Net State Support Resident Student Full-Time Equivalent Estimate		**70,000**
Estimated State Appropriations per State Support Resident Student Full-Time Equivalent		
Net State Appropriations for Core Teaching and University Overhead		$ 50,000,000
Net State Support Resident Student Full-Time Equivalent Estimate		70,000
Estimated State Appropriations per State Support Resident Student FTE		**$ 714**