

MEASURING THE EFFECTS OF FINANCIAL AID REVENUE ON COST AND QUALITY
AT AMERICAN LAND-GRANT UNIVERSITIES

By

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ABSTRACT

This analysis measures the effects of revenues in the form of state-based and federal grants on measures related to student cost of attendance and educational quality. Included in the cost measures are tuition and fee costs, as well as levels of institutional aid and debt levels. Quality is measured by instructional expenditures per student and academic caliber of incoming freshman. The sample of institutions is comprised of 14 public, land-grant universities in the U.S. Data from the Delta Cost Project is explained and coefficients are estimated using an OLS regression model. Findings indicate that there is some upward effect of financial aid revenue on tuition costs in some cases. Findings on the effects of grant revenue on quality suggest that aid revenue does impact quality, though the results are limited by small sample sizes.

I. Introduction

In his 2012 State of the Union, President Barack Obama called on colleges and universities¹ to keep their costs down, stating that institutions that continue to increase their costs may eventually find themselves in danger of losing their access to federal financial aid funding (Resmovits). The President's comments underscore a growing concern in the United States that middle class families are becoming increasingly unable to send a student to college. Echoing this concern, the President made his warning to post-secondary institutions clear: "If you can't stop tuition from going up, the funding you get from taxpayers will go down" (Resmovits).

Each year, it is not unreasonable to expect that colleges and universities will increase what they charge student, particularly in the form of tuition, in order to generate more revenue, which helps them compete with other institutions for the best students, faculty, and facilities. Interestingly, however, large increases in tuition have been accompanied by similarly large increases in enrollments in higher education across the country (Delta Cost Project, 2009). It is understood that a demand curve is downward-sloping, meaning that increases in cost should result in a decrease in the quantity of students demanding higher education, *ceteris paribus*. So, this paradox with respect to the law of demand suggests that in fact not all other factors are being held constant, which has allowed enrollment to increase despite increases in costs.

Of all of the factors that could possibly account for this paradox of increasing enrollments despite increasing costs, financial aid is a prime candidate. Not only does it play a role in the accessibility of a college education, it also has the potential to affect other factors in a post-

¹ The term "college" specifically means an institution that focuses on undergraduate education and offers four-year degrees, but is often used in a general sense to refer to any type of post-secondary institution. "University" is usually associated with institutions made up of more than one college that offers graduate programs in addition to undergraduate degrees. This analysis focuses in particular on public, land-grant universities in the United States, but the term "college" is used throughout this paper as a means of identifying any time of post-secondary institution (U.S. Department of State EducationUSA Glossary).

secondary institution, such as the quality of the education provided. The following analysis explores the role that financial aid, specifically state and federal grants, play in a university's policies regarding tuition prices/decisions. Section 2 explores why higher education is relevant to our society, and Section 3 explains recent trends in the market for higher education, followed by key considerations that make the market unique in Section 4. A review of existing literature regarding the role of financial aid is given in Section 5. Sections 6 and 7 include a description of the data analyzed and an explanation of the methodological framework, followed by Section 8, which gives the results of the quantitative analysis, and Section 9, a discussion of the results. Section 10 lists some limitations of the findings in this study while Section 11 offers some closing remarks and discusses a few of the findings of this study that should be considered by policy makers with respect to financial aid policies.

II. Background

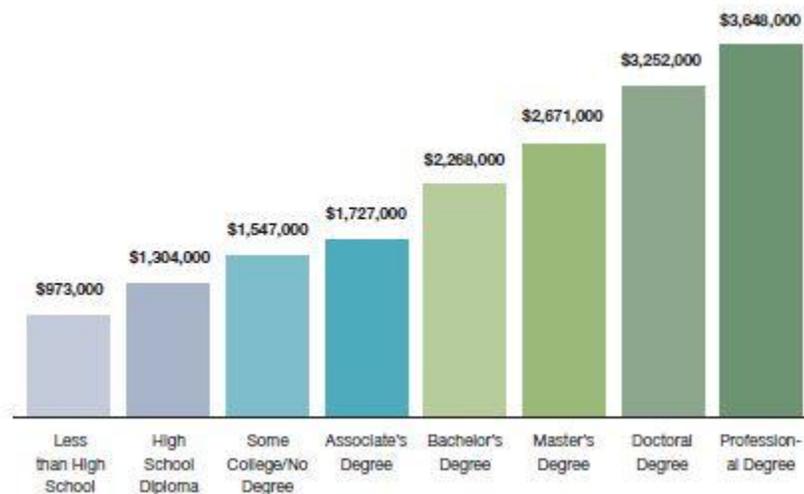
A. Relevance of a college education

Naturally, the above-mentioned paradox in increasing enrollments coupled with increasing tuition costs to students would be of little interest if higher education itself were not of serious importance to our society. Without headliners like Bill Gates and Mark Zuckerberg—perhaps the two most famous college dropouts in the United States today—showing young people the success that they achieved without a degree, it is still relevant to establish just how important a college education is for the career prospects of an individual. In the following section, I examine two different aspects that highlight this: workforce development and human capital, and international competitiveness and its policy implications.

1. Workforce development and human capital

It has been proven that the more formal education an individual receives in his lifetime, the better her life prospects become. In particular, as people advance in their schooling, their career prospects—and consequently their salaries—are likely to increase as well. In a study called *The College Payoff* (Carnevale et al., 2011), researchers at Georgetown University’s Center for Education and the Workforce find that a person with a bachelor’s degree stands to earn approximately \$2.8 million more over his lifetime than a person who only completed high school. Not only is this figure substantial, if not unsurprising, their research shows that the gaps in earnings between levels of education are increasing. In 1999, the average college graduate earned around 74 percent more than someone with only a high school diploma; this number has grown to 84 percent today (Carnevale et al., 2011; see Figure 1).

Figure 1: Median Lifetime Earnings By Highest Educational Attainment, 2009 Dollars



Source of Data: Carnevale et al, 2011

In addition, returns for obtaining higher levels of education are not fully internalized to the people who do so. Indeed, positive externalities resulting from having a more educated populace make more educated geographic areas more productive. For each additional year of schooling, a city’s productivity is shown to increase by 2.8 percent annually (Rauch, 1991).

Indeed, “[e]ducation is widely viewed as a public good (with positive externalities), which increases the efficiency of economic and political institutions while hastening the pace of scientific advance” (Schultz, 1988).

It is perhaps worth mentioning that not all researchers take this same outlook when viewing the benefits of human capital generated by obtaining a higher education. Barrow and Rouse (2005) contend that after considering the foregone wages and, to use their term, the “skyrocketing” costs of higher education over the past two decades, the net windfall in present value terms of obtaining a four-year degree is roughly \$300,000. While certainly not a negligible figure, it pales in comparison to the \$2.8 million mentioned previously. They explain that the booming economy of the 1990s allowed wages for workers without a bachelor’s degree to increase at a pace that narrowed the gap between college graduates and the less educated. However, since the mid-1990s, low-skill jobs have been increasingly shipped overseas and the recent financial crisis and subsequent recession saw the less educated get hit the most severely in regard to unemployment (Jilani, 2011; Alini et al., 2009). Despite these findings, Barrow and Rouse (2005) agree that a college education is a worthwhile investment.

In addition to the benefits an individual receives in earning a undergraduate degree, communities also benefit when the education level of people living in them increases. Seeing both the individual and group benefits stemming from college education, the United States will likely need to continue generating college-educated workers in order to remain competitive in the global economy.

2. Global competitiveness

The United States has by far the largest economy in the world with a Gross Domestic Product (GDP) over \$15 trillion, which is more than double the next largest economy, China

(IMF, 2012). However, by looking how the U.S. compares to other developed and developing countries, it is not unreasonable to ask how long it will remain the largest economy in the global marketplace. A 2009 international assessment of high school sophomores conducted in 65 of the world's most developed countries ranked the U.S. 17th in reading education, 23rd in science, and 31st in mathematics (U.S. Department of Education, 2010).

Despite these statistics, there has been another trend emerging that may be indicative of an even bleaker future for American education compared to other developed and developing countries. For decades, a college education was effectively reserved for only the top high school graduates. The film *Waiting for "Superman,"* a documentary chronicling the plight of the American education for the past few decades, explains that only about 20 percent of high school graduates would go on to college while most others would transition directly into the labor market and be able to support themselves and their families with the wages they earned. Today, globalization and the increasing skill levels of workers in developing countries have made the ability of a low-skilled American worker to support himself much more difficult, as highlighted by the increasing wealth disparity between those with a college degree and those without. Policies adopted by foreign countries to increase their educated workforce in size, like China's creation of entire cities with the capacity to educate literally hundreds of thousands of students at a time, are making the global labor market increasingly congested with skilled workers according to Brown (2011). What is more, these foreign workers are often willing to work for much less than their American counterparts, leading many major U.S. companies to look abroad in order to fill their ranks as a means of saving costs (Brown et al., 2011).

This increase in skilled workers in developing countries has led to a fascinating change in the very meaning of higher education. Whereas earning a degree was once considered an

opportunity to advance one's career prospects and to make a better life for oneself, higher education has turned into a "defensive expenditure." Individuals are pushed to invest in their education not simply in order to better their career prospects, but rather to give themselves "any chance of fighting for a decent standard of living" (Brown et. al., 2011). This shift is described as the "opportunity trap." Brown et al. (2011) explain that by providing more individuals with the opportunity to obtain a bachelor's degree in the global marketplace, it becomes less of an advantage and instead only serves to "raise the entry bar" for all workers. What this means for American policymakers is that in setting policies that affect access to bachelor's programs, they are no longer working to find ways to give individuals an advantage in the economy. Instead, they are considering policy decisions that will give them a chance of competing for a desirable standard of living at all.

3. Implications for policymaking

With the need to continue educating students in the wake of declining state appropriations for education, policymakers would be wise to advocate that policy decisions made at the federal-, state-, and university-level ensure that enough students are indeed receiving a quality education that will keep them and the American workforce as a whole competitive in the global marketplace. As it currently stands, allocation of resources may not be as appropriately allocated as possible to achieve the maximum effectiveness for these funds. A simple example of this concern regarding allocation comes in the Free Application for Federal Student Aid. The sheer complexity in the application form is estimated to cost applicants over \$4 billion annually (Dynarski and Scott-Clayton, 2008). With the countless transactions between governments, students, and institutions in the higher education industry, failure to properly effectively coordinate policy between the many agents has the potential to cost the country in the long run.

These questions of policy and missed opportunities for coordination, though, go well beyond the individual student. Over the past two decades, there has been a shift in the role that student financial aid plays in regards to the affordability of college, as well as a shift in the composition of aid packages awarded to students. These shifts, however, do not appear to be the result of calculated policy prescriptions, but rather the result of state and federal budgetary pressures (McPherson and Schapiro, 1996). Without effective coordination between tuition and institutional aid policies set by universities, policies regarding grant aid offered by states, and federal grant and loan policies, students may find themselves unable to afford a degree. One study found in the mid-1990s that there was a relatively weak correlation between average in-state tuition and per capita need-based aid and that only about one-sixth of the variation in state-based aid can be linked to tuition. As state funding for higher education has decreased over the past two decades and tuition has risen, these numbers are likely to be even starker today. Policy makers may also wish to periodically reevaluate these policies and how they interact because the effects of aid can change over time (St. John, 2001). Without clear coordination between need-based aid policies from the government and merit-based award policies from colleges, financial aid may become more important in influencing which institution an already college-bound student attends rather than ensuring that he is able to attend any institution at all (Doyle, 2010).

Not only is financial aid policy important to evaluate because of its implications to college access, cuts in state appropriations over the past few years alone may have far-reaching consequences into the future. As the American labor pool moves further into the 21st century, the careers in highest demand in the market—technical, healthcare, engineering, etc.—may have trouble filling their ranks because these skills are the most expensive to educate and many colleges and universities find themselves cutting these costly programs in the wage of reductions

in appropriations. So far, public colleges and universities in seven states have cut entire engineering or computer science departments (Rampell, 2012). If the United States does not push for access to quality degrees for fields with increasing job opportunities, it will find itself left behind in the transforming global marketplace. We can now look to some state and federal trends to see if our policies have in fact been effective in creating this reality thus far.

B. Recent trends and history

Dramatic cost increases over the past three decades, coupled with the declining real value of financial aid, has many questioning whether or not students are now able to reasonably obtain a degree without taking on cumbersome debt loads. These concerns stem from developing trends that have taken shape over the past several decades. Following World War II, public universities in the United States received increased levels of financial support from state and local governments as a result of increased tax revenues from the economic boom of the post-war years (McPherson and Schapiro, 1996). This trend of increasing support came to an end around the mid-1980s for reasons that are not entirely clear, but the effects of weakening public support have been felt at U.S. institutions ever since. As universities have found themselves strapped for cash as a result of shrinking state appropriations and increased costs as a result of competition for the best and brightest students, the students themselves have been increasingly utilized as a revenue stream in order to maintain institutional operations (SHEF, 2011; Hillman, 2011). Since the mid-1980s, grant aid from any source has been unable to keep pace with increasing costs of attendance and students are turning to debt in order to finance their educations (College Board, 2011).

In the last ten years, federal spending on financial aid programs has increased by 164 percent (Hough, 2012). While this may suggest that policy options have been adopted to ensure

access to American institutions of higher learning, three-fourths of Americans are reporting that they believe a college education is unaffordable for most people, according to a 2011 Pew Research Center report. This feeling of unaffordability is likely linked with the fact that Pell grants, the primary grant aid offered through the federal government, have lost much of their purchasing power since the 1980s (Doyle, 2010). Interestingly enough, federal grant aid makes up the greatest proportion of total grant aid, coming in at just under 50 percent of all grant money awarded. The federal government spent a total of \$107.2 billion on grants for the 2010-2011 school year and the average Pell grant² award was \$3,828 (College Board, 2011). In recent years, budgetary pressures stemming from the financial crisis brought down the level of state appropriations at most public universities, including expenditures on state-based student aid. As a result, federal spending on aid has taken on a greater proportion of all aid awarded, increasing from 34 percent in 2000-2001 to 51 percent in 2010-2011. Overall, the federal government spent \$227.2 billion on all forms of aid in 2010-2011 (College Board, 2011).³

The average full-time equivalency (FTE) student received \$12,455 in total aid from all sources for the 2010-2011 school year. This figure reflects roughly \$6,539 in grant aid, including federal grants like Pell, state-based grants, institutional grants and scholarships, and private or corporate scholarships (College Board). In addition, the average FTE student received nearly

² The Pell grant is the most common and well-known of the federal grants available to students. Pell grants range in amount between \$100 and \$5,550 and are awarded to students demonstrating financial need. Need is determined based off of the student's Expected Family Contribution based on information gathered when the student complete's the Free Application for Federal Student Aid. Other grants are available through the federal government, but they are less common. The Federal Supplemental Educational Opportunity Grant (FSEOG) is available to students with extreme financial need and awards range in size from \$100 to \$4,000. There are also grants available for students whose parents died while serving in the military in Iraq or Afghanistan after September 11th, 2001, as well as for future teachers who meet specific requirements. In addition to grant aid, the federal government also offers both subsidized and unsubsidized loans to students and their parents and sponsor work-study programs that reimburse institutions for part or all of a student's wages while the student works on campus (U.S. Department of Education, 2012).

³ While financial aid in the forms of loans and grants is an important method by which the federal government funds universities, it is not the only way it does so. A substantial portion of research expenditures are generated through federal grants awarded to research institutions. This funding has also seen a trend of decreasing purchasing power (McPherson and Schapiro, 1996).

\$5,000 in loans for the same school year. This shows the ongoing, observable trend that combined aid packages are shifting away from grants, which the student is not required to pay back, to loans that students acquire in order to cover school expenses and begin to pay back once they leave school (St. John, 2001). In the past decade alone, student borrowing has increased 53 percent per FTE for all sectors of higher education combined. In 2009-2010, more than 55 percent of undergraduates graduated with some amount of debt, and for those that did, their average bill was roughly \$22,000. The topic of debt continues to receive increased media attention now that the total amount of students in the United States has eclipsed credit card borrowing and just recently passed the \$1 billion mark.

Much of the nominal increase in federal support has coincided with decreasing levels of state support for public institutions. At first glance, the issue of state support may not immediately stand out when examining state funding numbers from around the country because state funding for public colleges and universities has grown by leaps and bounds on a nominal basis. In 1985, states contributed \$29.1 billion in general operations funds to their public institutions. Ten years later that number had grown to \$42.1 billion, and by 2008 universities were receiving \$88.9 billion from the states (College Board, 2011). However, as appropriations increased, so too did enrollments at these institutions. Between 2000 and 2010, FTE at all institutions in the United States grew by 35 percent reaching 11.6 million FTE students in 2010. Comparatively, that number was only 7.2 million FTE nationally in 1985. Public research institutions were especially hard hit, losing \$1,500 in state funding per FTE between 2002 and 2005 alone (Delta Cost Project, 2009).

Another important consideration in this analysis is the rapid change in the higher education landscape that accompanied the recession following the 2008 financial crisis. High

unemployment reduced the opportunity costs for thousands of jobless Americans to obtain a degree, whether in a two- or four-year program, so enrollments surged (Hoover, 2011). This was coupled with huge reductions in state revenue from lost sales and income tax, which resulted in the inability of states to properly fund their colleges and universities. Between 2008 and 2011, total state funding declined by \$1.4 billion. All of these factors resulted in 2010 marking a 25-year low in state funding per FTE.

The 2008 financial crisis, while especially difficult, was not the only instance of decreased funding for state universities during a recession. Of course, almost all state-run entities suffer in the wake of substantial reductions in revenue. The primary concern here stems from the fact that in each of the last several recessions, public higher education has not seen its budgets return to full strength following these cuts made during poor economic circumstances (Rampell, 2012). It is as though after each recession, public universities emerge slightly less funded than before.

As a result of these declines in per student funding at these universities, institutions have been forced to rely more heavily on the students themselves in order to maintain revenues. As state appropriations shrink, tuition has emerged as the most viable alternative revenue stream. And while this trend can be observed over the past several decades, this shift in costs from the states to the students has accelerated in the past few years (Hillman, 2011). Between 2008 and 2010, tuition as a share of total revenue for universities increased from 33.6 percent to 36.2 percent (College Board 2011).

Students are not only directly contributing an increasing share of their institutions' total revenue in the form of tuition, but their tuition dollars are comprising an increasing percentage of instructional expenditures as well. In 1985, net tuition revenue, or what students pay after

institutional grants and scholarships, contributed 23 percent of instructional expenditures made public colleges and universities. Today, it accounts for about 40 percent, almost double what it was in 1985 (Rampell, 2012). This shift is likely reflective of the earlier-mentioned paradigm shift in the belief of who most benefits from being more educated. As Ronald Ehrenberg, director of the Cornell Higher Education Research Institute, explains, “[t]here has been a shift from the belief that we as a nation benefit from higher education, to a belief that it’s the people receiving the education who primarily benefit and so they should foot the bill” (Rampell, 2012).

However, the change in the composition of educational expenditures is not the only consequence of state divestment in public higher education. Indeed, as costs have increased and aid programs have seen their purchasing power decline, institutions have been forced to take up a heavier burden in regards to financial aid (Hillman, 2011). Like many other trends we have observed, this has been one that has happened over the past several decades and has sped up during the recent recession. In 2008, total institutional grant aid in the United States reached approximately \$28 billion. This stands in contrast federal- and state-based aid programs, which totaled \$14.4 billion and \$7.9 billion respectively in the same year (Doyle, 2010).

This shift has significant consequences because as the source of these awards has changed, so too has the motivation to award them. Governmental aid, particularly from the federal government, is targeted primarily at students with financial need. The Pell grant, the largest federal grant program in terms of overall spending, is awarded to students based on the costs to attend their chosen institution and their measure of need known as the Expected Family Contribution. The idea is to give lower-income students the opportunity to attend college through financial assistance when it would otherwise be cost prohibitive for them to do so. Universities tend to take more into consideration when they award aid beyond improving access. To them, aid

is more of an opportunity to craft a class of diverse, academically talented students (Hillman, 2011). These more nuanced aims, coupled with competition between institutions for the most talented students, are leading schools to become less responsive to financial need when making aid awards and more concerned with the academic record of the individual (Doyle, 2010). The patterns of higher tuition and fees have meant that while less academically able but more financially secure students have been able to continue enrolling at consistent rates, more talented students from the lower end of the income spectrum have seen a drop in enrollment (McPherson and Schapiro, 1996).

Finally, one final trend worth noting that will not play a significant role in the subsequent analysis is the increase in popularity of for-profit colleges and universities. Examples of these for-profit institutions include The University of Phoenix and DeVry University. As a result, federal aid programs like Pell have seen huge shifts from non-profit colleges and universities to these for-profit colleges and trade schools. Many of these schools receive more than 90 percent of their total revenue from federal dollars through financial aid programs. Across the industry, that accounts for nearly \$30 billion annually (Halpern, 2012). As the popularity of these schools grow and enrollments increase, there has also been increasing skepticism regard the value of the degrees for-profit institutions offer.

These trends can be summarized as follows: 1) it is becoming increasingly difficult for student to afford a college degree as costs have increased at an alarming rate due to state divestment; 2) financial aid, one of the most important factors is college affordability, has lost much of its purchasing power and students are turning to loans in order to be able to afford their tuition and other educational costs; and 3) students are also now in many cases contributing more to their own instruction than the states that subsidize them, marking an important paradigm shift.

In what follows, I will examine how this change in state and federal funding for financial aid has affected a small group of public, land-grant, high research institutions from across the country. Particular attention will be paid to analyzing whether changes in aid have significantly affected costs at these universities and the levels institutional aid they provide as a result. I will also explore whether changes in aid have affected instructional expenditures per student and academic caliber of incoming students, two common measures of institutional quality, as well as levels of debt that students are taking on. Before moving to the review of existing literature, there are a few market nuances that should be acknowledged/mentioned when assessing the market for higher education in general.

C. Key market considerations

Years of research have produced thousands of articles examining exactly what makes the market for higher education work in the fashion it does. These studies have produced among others, three considerations that should be taken into account when studying higher education. They are the role of uncertainty in the market, the mission confusion experienced by many institutions, and the unique role played by students of both inputs into and outputs of their education.

The first of these is the high degree of uncertainty that exists in the market on the part of those who seek to invest in higher education—namely, students and the government. On the part of students, there is a “leap of faith” that student take when deciding to attend college because the exact benefits they will receive by earning a degree are unknown to them when making the decision. Not only are there opportunity costs for traditional students associated with foregoing several years of income in order to complete a degree, there is no certainty that when they graduate they will be able to obtain a job that will give them the lifestyle they expected as a

result of their investment; different students will experience different results (Dynarski and Scott-Clayton, 2008). The simple fact, as articulated by Winston (1999), is that those who invest in their own human capital by obtaining a degree “don’t know what they’re buying—and won’t and can’t know what they have purchased until it is too late to do anything about it.” It logically follows that states realize this as well. When legislators are unsure of the returns that tax dollars will generate if invested in higher education, they may be more inclined to shift costs away from state appropriations and onto the students themselves who are receiving the education. This may be the underlying rationale behind the cumulative state divestment from publically funded institutions over the past several decades.

Furthermore, students from different socioeconomic backgrounds will encounter different expectations about the benefits of a bachelor’s degree which will affect their decision of whether to enroll. One example of this is illustrated in the way in which lower income students tend to overestimate the costs of attending college (Lillis, 2008). In so doing, they decide against seeking a degree due to incorrect assumptions under which they or those around them operate.

Another area of uncertainty that is especially relevant to this analysis is that associated with the financial aid application and receipt process. Many students do not fill out the Free Application for Federal Financial Aid—the form through which Pell grants and federal student loans are awarded—or apply for institutional grant aid because they are unaware that these programs exist or because they are too complex (DesJardins et al, 2006; Dynarski and Scott-Clayton, 2008). In addition, federal and institutional awards are typically awarded in the spring of a prospective student’s senior year. By this time, the application deadlines at many schools have already passed, meaning that students usually need to make up their minds about whether or not they are going to matriculate before they are able to consider the financial aid package they

will be receiving. This disconnect keeps many students, especially those from lower-income or minority backgrounds from applying for college.

A second unique characteristic of the market for higher education is the ambiguity as to who the institutional stakeholders are, and in turn, what their goals are. Winston (1999) describes this relationship with a metaphor, saying that universities are “part church and part car-dealer;” the former in that they provide the public with the knowledge generated in the labs and offices and offer students an opportunity to expand their understanding of the world, but also the latter because this knowledge generation comes with a hefty price tag and they must charge tuition and fees in order to remain functioning.

So what really motivates an institution of higher learning? Whatever the answer may be, understanding it more fully will help explain how aid is distributed in the manner that it is. Some contend that universities and colleges work to maximize their prestige by improving the quality of students they admit, their quality of instruction (however they choose to measure it), and even increasing their level of selectivity for admissions (Long, 2004; Winston, 1999). Others have suggested that these motivations are more driven by maximizing revenue. Hillman (2011) states that from the budgetary perspective, “the most important reason why a university offers financial aid is to enhance net tuition.”

Part of the confusion concerning what the institution’s aim should be, and therefore how it distributes its financial aid, may be attributed to difficulty in ascertaining who ‘the university’ actually is. There are indeed many stakeholders in the university environment who make decisions and may have different motivations. While the goals of some members of this enterprise, such as faculty and students, may be easier to model, motivations of others like administrators and regents are not easily understood (Rothschild and White, 1995). The

components of the student experience are known in most cases (academics, student lifestyle, facilities, etc.); the strategies that administrators employ in order to maximize the prestige of their institution are vary widely, and are therefore more difficult to discern.

The final overriding consideration that makes the market for higher education distinct is the special role that students play as both an input and output of their education. Students attend college and receive an education and the human capital generated from that increase in knowledge is an output of that education. However, students also contribute to the education of others. The quality of an individual's education is greatly influenced by his fellow students. As Epple and Romano (2003) explain:

A student surrounded by able and motivated peers may benefit from higher quality in-class discussion, help outside of class in understanding difficult material, stimulating bull sessions, role models that encourage conscientious completion of homework assignments, and competition that fosters thorough preparation for examinations.

So what we have here is a market in which the entities traditionally thought of as providing the output (universities) are actually competing for the 'customers' (students). Students pay a price for the services they receive in the form of tuition, but that tuition is often discounted in the form of merit aid as a type of wage offered to the student for the benefit that he provides to his colleagues by participating in their same learning environment (Rothschild and White, 1995; Ehrenberg and Sherman, 1984). This has particularly important implications for the provisions of institutional aid because it shows the give-and-take relationship that exists between colleges and students. Groups of students that are more attractive to the university, whether in terms of racial background, academic characteristics, athletic ability, legacy status, or others, will logically be charged a lower price to attend the school (Ehrenberg and Sherman, 1984).

III. Literature Review

To begin, it will be helpful to examine studies that look specifically at student demand and how changes in cost affect the enrollment and persistence of students. Leslie and Brinkman (1987) provide a review of the existing literature studying student demand for higher education. They compile the results of other authors and produce a single measure to assess the level of demand, and then they draw conclusions about how students react to changes in the costs of college. The primary interest is to determine how many students are deterred from attending college by as a result of tuition costs increasing. Their basic unit of measure of the price response, the student price response coefficient (SPRC), was first used in an earlier study conducted by Jackson and Weathersby (1975). The SPRC measures the change in enrollment due to a \$100 change in tuition. Overall, 25 different papers were used in the analysis and they find that for each cost increase of \$100, the enrollments of students aged 18 to 24 drops by 2.1 percent, *ceteris paribus*. Also, they find that aid awards have less impact on changes in enrollment than a tuition change of the same amount, although they acknowledge that other authors using different measures of student price response find the opposite. They conclude that high aid programs in the context of an institution with higher tuition are likely to be more effective per dollar of government subsidy than low tuition policies.

Heller (1997) conducts a similar review of the existing student demand literature, suggesting that Leslie and Brinkman's (1987) analysis, while useful, needed to be updated as costs to students in higher education had risen quite rapidly in the decade between the two studies. The literature Heller (1997) reviews further explains the relationship between different types of aid and how cost changes affect various racial, socioeconomic, and college sector categories. Heller (1997) finds, consistent with Leslie and Brinkman (1987), that there is an inverse relationship between tuition and enrollment rates. However, he estimates that enrollment

drops by 0.5 and 1.0 percent for every \$100 tuition increase. Heller (1997) extends the literature by emphasizing the idea that students act as sometimes-non-rational actors and react differently between different types of financial aid (e.g., grants, loans, work study, etc.). There is evidence suggesting that students will respond to the college “sticker price” because they are unaware of the various financial aid programs or believe that they would not qualify for it.

Dynarski (2003) used the elimination of a Social Security component to arrive at the similar conclusion that different forms of financial aid work differently in easing access to higher education. From 1962 to 1982, the Social Security Student Benefit Program provided financial assistance to help with college costs to the children of retired, disabled, or deceased recipients of Social Security benefits. Dynarski (2003) utilized survey data from the 1979 National Longitudinal Survey of Youth to examine the differences in college attendance rates between students with living fathers and those whose fathers were deceased, thus making them eligible for benefits. These differences were then observed before and after the elimination of the program. The findings conclude that while the probability of enrollment dropped for students with living fathers by 2.6 percent, it dropped for students with deceased fathers by 20.8 percent. The ordinary least squares (OLS) regression analysis suggests that eligibility for financial aid plays a substantial role on whether or not the student will enter higher education. Dynarski (2003) also found that aid eligibility increased the amount of schooling that the student was likely to obtain.

DesJardins et al. (2002) studied how the changing nature of aid packages from predominantly need-based grants to merit-based grants and loans affects persistence enrollment of individual students in higher education. Specifically, they examine a group of several thousand students entering the University of Minnesota in 1986 and follow them for seven years,

then compare how their aid packages affected the amount of time they stayed enrolled in the University, or until they graduated. They find that federal aid did not keep students enrolled at the institution—rather, institutional scholarships did. Furthermore, the granting of different forms of aid may have less-obvious effects. For example, giving a student a scholarship instead of a loan or work study signals a kind of institutional commitment to the student, which then increases the student's commitment to the institution, thus affecting whether he decides to enroll there, transfer away, and drop out. Finally, the authors expand on Heller (1997) in noting the importance of disaggregating aid packages into their component parts, noting that students respond to a set of prices (like tuition, fees, room and board costs, etc.) and subsidies (grants, scholarships, loans, etc.) instead of a single net price including all costs and aid awards.

St. John et al. (2001) analyze how state-based financial aid programs affect persistence of individual student enrollment using random samples of college and university students in Indiana over three separate school years in the 1990s. They found that there was a shift in the composition of aid over the decade that emphasized loans. Their results also show that tuition increases outpaced grant awards and that average loan amounts for all students increased over the period studied. Their analysis concludes that financial aid packages were indeed relevant to persistence of enrollment for the groups studied, showing that the erosion of purchasing power of state grants, despite increased spending on the grant programs by the state, did negatively affect the probability of persistence. This contrasts somewhat with the conclusions drawn by DesJardins et al. (2002), although differences in the state-based aid programs in Minnesota and Indiana may account for the different conclusions the two studies draw. St. John et al. (2001) also point out that tuition policies set by the institutions and aid policies set by the state and federal government ought to be coordinated in order to assure maximum effectiveness in

increasing access to higher education; when considering revisions to state aid policy, federal aid policy, or institutional aid policy, changes in one should not be considered while disregarding the other two.

Institutional quality, however it is measured, is another aspect of higher education in which financial aid plays a role. Epple et al. (2006) construct a model in which institutions seek to maximize the quality of the educational experience students have. They choose peer ability and instructional expenditures per student to be the primary determinants of quality in the educational experience. They assemble data from Peterson's, the National Center for Education Statistics, and the National Science Foundation on private colleges and use an OLS estimation method.⁴ They conclude that financial aid awards are significantly higher for higher ability students.

In their earlier work, Epple et al. (2001) find that not only do schools value quality in their students (and thus discount tuition on the basis of ability in most instances in order to maximize student ability), they further explain that there is a stratified hierarchy that has developed among institutions with regard to quality. This stratification makes it difficult for colleges and universities to increase how the quality of their education is perceived related to other institutions and stems from applicants seeking out the schools with the best quality of enrolled students, thus giving greater market power to the higher quality schools and allowing them to charge more and spend more on aid and instruction. They also find a positive correlation between SAT scores, endowment per student, and expenditures per student. The results they find suggest that there is competition among institutions to attract the best students if the

⁴ Peterson's is an information source for student, parents, and educators about various colleges and universities, as well as different degree programs around the country. The NCES is a division of the U.S. Department of Education that conducts periodic studies in many sectors of education at all levels. Specifically, they conduct a number of annual studies on colleges in the U.S.

maximization of institutional quality is indeed the goal of these institutions and that award of merit aid is the primary means of competition.

Winston (1999) offers a similar picture of the market for higher education. He explains that schools with access to greater donative resources have a greater ability to subsidize high-achieving students, which in turn increases the quality of the students who enroll.⁵ The effect of more high-performing peers creates greater demand from students wishing to surround themselves with stronger peers, thus increasing excess demand and enabling the institution to be more selective. This selectivity allows the institution to further increase the quality of students admitted and a continuous feedback loop is formed. Winston (1999) also furthers the literature on student demand offered by arguing that because the listed price of tuition and fees is sometimes a poor indicator of what a student will actually pay in terms of net price, educational quality is also an important component of demand.

In contrast to strategies for institutional aid to maximize quality, Mohrman (1987) offers insight into how changing packages of federal aid may be causing unintended consequences negatively impacting the quality of a student's educational experience. She suggests that as federal aid packages move increasingly to focus on loans, a student's understanding of the college experience also shifts, making the individual's time in college more focused on what will be done after graduation. This concern turns higher education into more of a vocational training instead of an opportunity for discovery. Mohrman (1987) also references evidence that indebtedness upon graduation could be the reason why students are turning away from majors that yield with lower-paying careers, like education and the social sciences. She uses the term "invisible dropouts" to describe growing group of students who are forced to work more hours at

⁵ This means that older, more established institutions with large endowments like Harvard, Princeton, and Yale have a greater ability to attract the most academically gifted students than younger institutions or schools with lower alumni donation rates.

a job to compensate for the declining purchasing power of federal grants rather than investing that time in studying or extracurricular activities.

As a final consideration for quality, Henry and Rubenstein (2002) show another side of how financial aid can improve the quality by showing its effect on what is known as the student pipeline. The authors sought to examine the relationship between standardized test scores (SATs) and grades (GPA) achieved by Georgia high school students between 1989 and 1999, a period encompassing both before and after the HOPE (Helping Outstanding Pupils Educationally) Scholarship was instituted. HOPE provides Georgia students with a 3.0 cumulative high school GPA with a full waiver for tuition and fees and an allowance to purchase textbooks. The authors' OLS regression analysis found that in the time period studied, the percentage of Georgia high school students earning a B average or better, having lagged behind the national average, increased at a faster rate than both the rest of the southern states and the United States overall after HOPE was introduced, climbing at 1.1 percent compared to that national average of 0.8 percent. But as Henry and Rubenstein (2002) point out, increases in GPA without increases in test scores simply indicate grade inflation rather than achievement gains. This, however, was not the case in Georgia. The authors found that despite declining test scores for those with a B average before the introduction of HOPE, that trend reversed after HOPE began. On average SAT scores for the B-average group in this time period increased 33 percent more than the rest of the country. These results indicate that states can use merit aid to incentivize high school students to increase their achievement and make them a better quality student before they reach college. Since public institutions are largely comprised of students from the state in which they are located, it would seem that offering merit awards like HOPE to in-state students would increase student quality and therefore increase institutional quality.

The effects of financial aid on costs of attendance are also relevant to this analysis. Hearn et al. (1996) examined all 50 states and how tuition and discounting policies among their public institution differed. Specifically, they looked to see what role region, available resources, and governance structures play in tuition and aid levels. Secondary data was assembled from three other studies and NCES data to reflect the 1985-1990 period. They found that region was unquestionably the most significant consideration in tuition levels at public, four-year schools and that larger states tended to award more aid per capita than smaller states. Also, their analysis shows that economically developed are more likely to have especially low cost entry points into higher education, leading them to conclude that there is support for previous work showing that low-priced, targeted educational opportunities may be more useful as a long-term economic development strategy than adjustments to tax and interest rates.

Lillis (2008) asks what role socioeconomic status plays in the decision to apply for college and seeks to prove whether or not students make their decisions to attend college based on cost. He studied a stratified random sample collected during the 2006-2007 academic year of 447 freshman in which institutions are separated into high-cost and low-cost categories and students are separated into high-income and low-to-middle-income groups. He found that high-cost institutions receive fewer applications and that family income also plays a role in whether a student is more likely to attend a high-cost institution compared to a low-cost institution. Lillis (2008) also finds that students in the high-cost context are more greatly influenced by the award of aid and that both low-income and high-income students make decisions regarding attendance based on financial aid awarded. He explains that students from the low income category are influenced by the award of aid more than their more wealthy counterparts.

Long (2004) uses the Bennett hypothesis as motivation for studying whether or not the influx of financial aid plays a role in the tuition-setting decisions of universities. William Bennett, the Secretary of Education in the Reagan administration, wrote a widely-cited 1987 *New York Times* editorial arguing that when federal student aid is increased in the form of grants or loans, colleges simply raise their prices in order to capture more revenue. While there is debate in the literature as to whether or not increased aid results in increased tuition at universities, Long (2004) takes the introduction of the Georgia HOPE scholarship, a form of state-based financial aid that can be taken to either a public or private institution in Georgia, to examine whether or not an increase could be seen after its introduction. Her study examines data from the IPEDS database from Georgia public and private colleges and universities from the 1989-1990 to 1996-1997 school years, a period of four years both before and after the introduction of the scholarship, as well as data from the Georgia Student Finance Commission on recipients of the scholarship at each Georgia institution. Results were mixed, finding that while the influx of additional aid did not play a significant role in raising tuition costs at Georgia public colleges, room and board did see a significant increase, as did tuition costs at private colleges in the state. Long (2004) attributes this lack of change in tuition at public schools to possible political pressure from the state legislature to keep tuition low. The study also finds that state appropriations were not affected.

Singell and Stone (2006) looked specifically to Pell grant data to analyze whether or not the Bennett hypothesis holds true. They studied data housed in the Computer-Aided Science Policy Analysis and Research Database System (CASPAR)--specifically surveys conducted by the National Center for Education Statistics (NCES) between 1989 and 1998, and Pell data collected by the Department of Education between 1988 and 1996. They modeled the data using

OLS, fixed-effects, and fixed-effects IV estimators and found that while the aid had an effect on sorting in-state students into relatively more expensive schools within the state, there was no significant relationship between average Pell awards and in-state tuition. These results do not support the Bennett hypothesis for in-state students at public universities, but the analysis finds otherwise for out-of-state tuition. Depending on the estimation strategy, they found that tuition charged to out-of-state students rises between \$431 and \$804 per every \$1,000 awarded in Pell at public universities. They also find that Pell grants and tuition increase nearly one for one at private universities.

Gillen (2012) used a number of different approaches to update Bennett's hypothesis in a report for the Center for College Affordability and Productivity. He sums up much of the available literature by stating that most studies that find no support for Bennett's hypothesis in at least some segments of higher education, many find support for some it in some segments, and where it is seen, the increase in tuition is typically less than the increase it aid. He explains that the nature of competition in higher education is based on maximizing prestige because there is no universal quality metric by which universities can be compared with each other. As a result, universities compete for rankings, which is a zero-sum game.⁶ He concludes that the nature of competition dictates that there is no limit to the amount that a university will spend to maximize prestige. Interestingly enough, he also provides a game-theoretical explanation to expand on this, showing a Prisoner's Dilemma-type game in which two universities faced with the choice of raising tuition or keeping it level with both rationally opt to raise because failing to do so will leave them less resources with which to maximize prestige and if their competition does, they

⁶ In Game Theory, a zero-sum game is a situation in which the gains and losses of all players eventually sum to zero, meaning that no one player can gain without at least one other player losing. In this instance, college rankings are zero-sum because no institution can move up in rankings without at least one other institution moving down.

will likely fall behind in rankings. He adds that the addition of more federal aid sparks a viscous cycle that allows colleges to increase tuition to gain more revenue, which in turn means more aid is necessary to maintain access.

Hanushek (1989) further explores the seemingly inefficient federal aid policies regarding financial aid. He finds that while federal aid has had some effect on attendance overall, it has had a larger impact on students' choice of institutions, showing the federal grants and loans have enabled many students to be able to afford four-year institutions instead of the low cost alternative provided by two-year colleges. Hanushek (1989) acknowledges some common policy recommendations to improve access, such as expanding existing programs, refocusing current programs to give more aid to fewer higher-need students, and the creation of new programs. He eventually argues that there is no compelling reason to expand the amount of current subsidies because gains from higher education are captured by the individual receiving it. He also concludes that while it may be beneficial for the federal government to facilitate borrowing for students, there is no strong argument related to why the government should subsidize those loans.

Rothschild and White (1993) seek to understand why universities do not engage in more price discrimination. Price discrimination in higher education comes from institutions attempting to maximize revenue by determining a student's willingness or ability to pay with an instrument like the Free Application for Federal Student Aid (FAFSA), then discounting tuition with grants and scholarships while still charging as much as a student is able to afford. The authors argue that institutions could increase revenue if they increase tuition and selectively increase aid for those who would otherwise be unable to afford the increased price while generating greater revenues from those who can. Contrary to research previously discussed, they do not believe that

student do in fact respond to the net price they are offered (tuition minus grants) rather than tuition and aid separately. They offer a likely reason that universities do not engage in this type of behavior is due to price competition among different schools. With respect to aid, they suggest that the positive externalities of attracting a minority or high-achieving students enhances the student experience at the university, thus internalizing the externality when other students are willing to pay more for the enhanced experience.

IV. Conceptual Framework

The preceding sections have highlighted the historic trends in the market for higher education as they pertain to college affordability and financial aid. As evidenced above, financial aid, both as an award to students and as a form of revenue for colleges and universities, has impacted not only the ways students as consumers react in the market, but also the ways in which institutions as producers respond to students. University policies related to questions of affordability and quality appear to be related to the revenues they receive in the form of financial aid dollars. To investigate this, an OLS regression model that employs state and year fixed effects was devised.

The following functional form was generated to explore the variables of interest:

$$Y_{it} = \beta_0 + \beta_1 FederalGrants_{it} + \beta_2 StateGrants_{it} + \beta_3 StateAppropriations_{it} + \alpha TotalEnrollment_{it} + \sum_{t=1987}^{2009} \delta_t Year_{it} + \sum_{i=1}^{14} \Theta_i Peer_{it} + \varepsilon_{it}$$

where *FederalGrants* represents the amount of revenues received by a given university in the form of grants provided to students from the federal government, *StateGrants* is the amount of revenues received by the university in the form of grants provided to students from the state government in which the university is located, *StateAppropriations* measures the amount of

funding received by the university in the form of state appropriations, and *TotalEnrollment* serves as a control term representing the number of students enrolled in the given institution. Regressors representing state and federal grants were chosen in order to estimate the effect that revenue for the institution from both types of aid had on the variables of interest. Additional regressors representing revenue from state appropriations and total enrollment were included as controls, as both are likely to play a role in determining how much a university actually receives in grant revenue.

Both the *Year* and *Peer* terms are fixed effect controls ensure coefficient estimates are not influenced either by trends in the macro-economy that may not be accounted for in the variables already included or by other factors specific to each institution that are also not accounted for already in the model. Consistent with this, the subscripted *i* and *t* terms indicate that each of the regressors is observed for a given institution in a given year. The error term is represented by ε . The term *Y* represents the value for given variable of interest being estimated by the equation.

The variables of interest for this analysis are: 1) both in- and out-of-state tuition and mandatory fees; 2) institutional expenditures on unfunded grants⁷; 3) the percentage of first-time, full-time students taking out loans; 4) the average loan amount taken out by first-time, full-time students; 5) the level of instructional expenditures per student; the 25th and 75th percentile ACT composite scores for entering freshmen; and 7) the 25th and 75th percentile SAT math and verbal scores for entering freshmen. Items 1-4 are all related to university policies pertaining to cost. Tuition and fees are the most direct illustrations of costs student incur, while institutional aid is the main tool colleges and universities use to discount the tuition and other costs they charge

⁷ There are two types of institutional grants: those that are funded and those that are unfunded. Funded grants are grants that have a separate funding source outside of the general university budget, such as an endowment established to fund a particular award. Unfunded grants are grants that are funded through the general university operations budget. Funds that are awarded in unfunded grants could be spent elsewhere in the institution if administrators saw fit, funding for funded grants can only go toward those particular grants they fund.

students. The remaining items 5-7 relate to quality. The level of instructional expenditures represents that financial commitment the institution makes to educating, while standardized test scores show the academic caliber of the incoming class, which can be used to assess peer quality.

There are a few points to clarify with regard to the functional form illustrated above. First, the decision to include state appropriations but not federal or local appropriations was a conscious one. Budget appropriations that make up land-grant university budgets come almost entirely from state governments. Most federal funding these institutions receive come in the form of research grants awarded to departments or professors within the institution to conduct research. Local appropriations play a large role in the budgets of community colleges, which are funded by the cities or counties in which they are located rather than the state; the research institutions examined here receive very little funding from local governments. It is also worth noting there is only one other control term (total enrollment) included in the model. It is appropriate to include this as a control because one can reasonably conclude that institutions with higher enrollments will likely receive more in grant funding because the grants are awarded to the students themselves rather than to the institution. Including only one other control term was due to limitations in the data.⁸ Other interesting considerations, including many basic demographic considerations about the student body like racial diversity and socioeconomic background, were either not included in the DCP data, were included but did not have enough observations to provide a robust statistical analysis, or were suspicious in observations reported and therefore not included in order to preserve the integrity of the analysis.

V. Data

⁸ In several instances, variables that were primary candidates to be used as controls, such as the percentages of in-state and out-of-state students, lacked sufficient observations to provide robust results with more than 100 observations.

The data analyzed in this paper comes from publicly available datasets released by the Delta Cost Project (DCP). The DCP is an affiliate of the American Institutes for Research that is committed to “improve college affordability by controlling costs” and “the belief that college costs can be contained without sacrificing access or educational quality” (deltacostproject.org). Data from the Delta Cost database was collected from the Delta Integrated Postsecondary Education Data System (IPEDS) database. The IPEDS database houses information gathered from every college, university, and technical school that participates in federal student aid programs. Each year, several surveys are conducted at these institutions to collect information on individual students like their financial background and basic demographic information, as well as institutional-level data on performance, such as student retention rates and graduation rates. The results are compiled and housed in the IPEDS database.

The data analyzed here corresponds to two different time frames: 1987 to 1998 and 1999 to 2009. Overall, more than 2,000 institutions are included in the data, including a total of 152 public research institutions. Data is organized as a matched set, meaning that the data in both time frames comes from the same institutions, to ensure variations in spending are not explained by different numbers of institutions reporting data.

For this analysis, 14 public, land-grant⁹ universities were chosen because the state of Arizona has seen some of the most intense budgetary pressures since the beginning of the 2008 recession, so the University of Arizona was selected as the first institution of study. Until the 2010-2011 school year, the Arizona Board of Regents (ABOR) used an established a list of “peer institutions” for each of the three universities in Arizona as a basis for comparison in

⁹ In 1862, Congress passed the Morrill Act, granting thousands of acres of land to states so that they could establish universities intended to benefit the state and make obtaining a higher education more realistic for Americans who were not either wealthy or well-connected. The mission of these universities often incorporates access and service to the state in which they are located into their mission statements.

performance.¹⁰ These institutions were chosen by considering the relative size of the institution, annual research expenditures, and land-grant status. Fourteen peer institutions were established for the University of Arizona and those are the institutions included in this study.¹¹ Each of the universities is a land-grant institution that is considered “high-research” with respect to annual research expenditures.

While it could be argued that comparisons across these schools are no longer appropriate due to ABOR no longer evaluating its universities directly against these peers, quite the opposite is true when considering why ABOR has shied away from comparison among these peers. The decision to eliminate the list of peers was made on the basis of considerations that the higher education landscape in Arizona, and across the country, had changed so drastically in the previous few years. By comparing these institutions, I am able to see exactly how they reacted differently in the wake of shrinking funding per FTE and the consequences of the different financial aid strategies they employed.

VI. Results

In 1987, the average sticker price of in-state tuition and mandatory fees among the 14 universities was approximately \$1,406; by 2009, average in-state tuition had increased to \$8,004. This change in sticker price represents a 469 percent increase. Using the Consumer Price Index (CPI) to adjust for inflation, this corresponds to a 201 percent in real terms.¹² Out-of-state

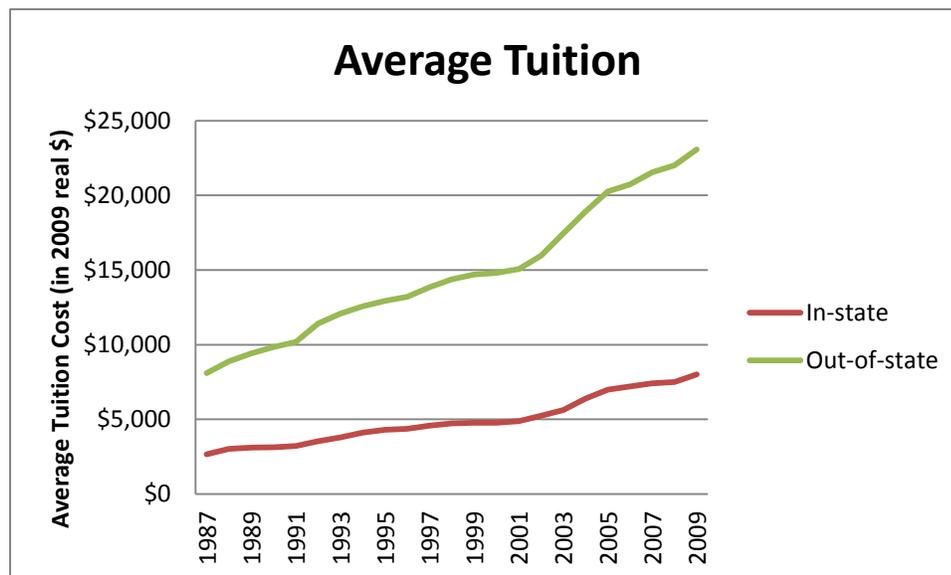
¹⁰ Citing the drastic changes in the higher education landscape following the 2008 recession and subsequent budget pressures at many public colleges and universities, ABOR opted to discontinue comparing Arizona’s universities to these peer institutions

¹¹ The full set includes the University of Arizona, the University of California-Berkeley, the University of California-Davis, the University of Florida, the University of Iowa, the University of Maryland, Michigan State University, the University of Minnesota-Twin Cities, the University of North Carolina-Chapel Hill, Ohio State University, Pennsylvania State University, the University of Texas, the University of Washington, and the University of Wisconsin-Madison. Texas A&M University was also included in the list of peers, but was omitted from this analysis due to irregularities and omitted variables in the raw data.

¹² The CPI is not without its faults. In particular, increases in costs among items in the basket of goods that the Index includes may not be reflective of the price level in higher education, but it is still the most useful measure

students encountered a similar increase in tuition, jumping from an average of \$4,290 in 1987 to \$23,078 in 2009. This represents an increase of 438 percent nominally and 185 percent in real terms (See Figure 2). To add some context in which to evaluate these figures, in that same period the CPI increased by 88 percent while the Higher Education Price Index (HEPI), a measure of inflation in determinants of institutional costs in higher education, increased 131 percent (Commonfund). While the value of a college degree in terms of the income differential between the high school and college educated may be increasing as mentioned above, these numbers show that the “sticker price” of obtaining that degree has increased at an even faster rate.

Figure 2



Source of Data: DCP 1987-2009

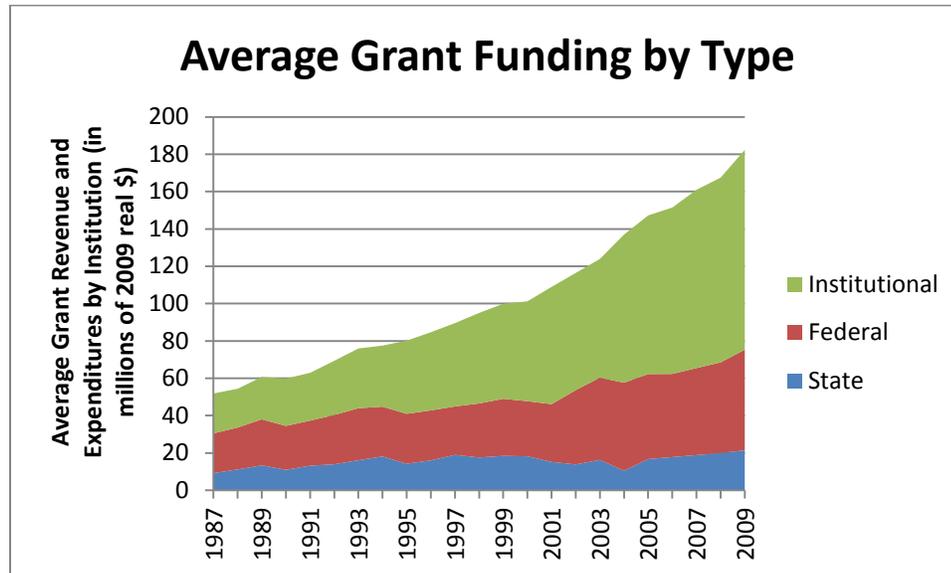
It would be inappropriate, however, to explore changes in listed tuition without also examining changes in financial aid levels.¹³ In the given time period, the total amount of revenue that these universities received from federal grants increased 378 percent, totaling an average of

to analyze how prices in higher education have increased in relation to typical goods and services purchased by consumers.

¹³ As mentioned in the literature review, the listed price of tuition is often not the cost that student eventually pay because institutions discount the price student pay for many reasons by awarding scholarships. State and federal governments, as well as private entities, also provide many students with grants that decrease their total cost of education.

roughly \$53.9 million in 2009. Similarly, the average revenues generated from state-based grants to students totaled \$21.4 million, an increase of 304 percent from 1987.

Figure 3



Source of Data: DCP 1987-2009

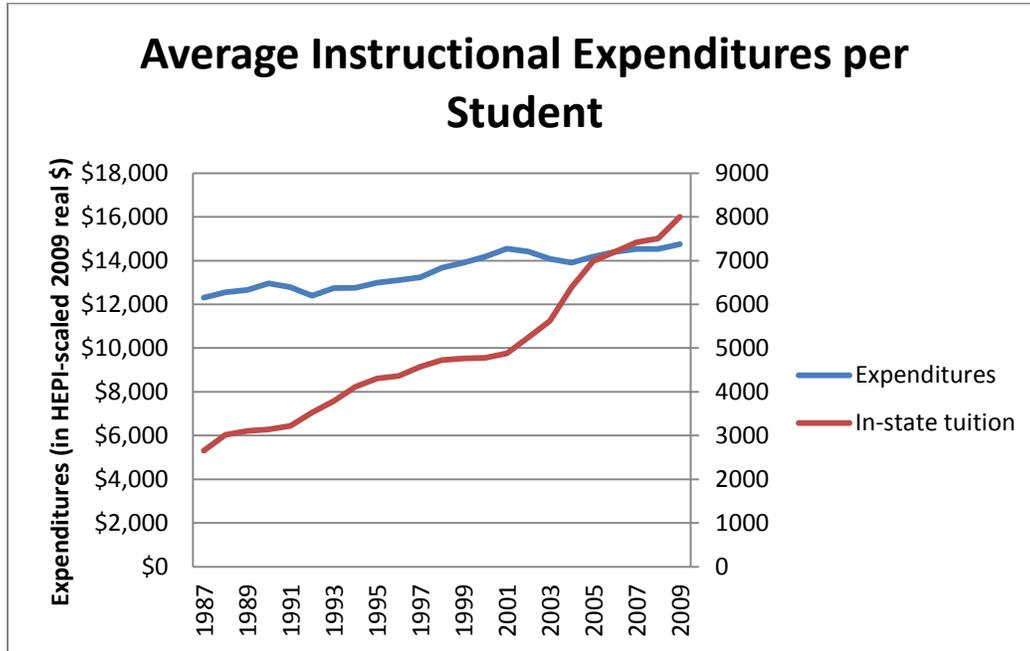
These data show, consistent with the literature, that while state and federal grants increased over this time period, they did so at a slower rate than the costs to students increased. This confirms that grant aid has indeed lost some of its purchasing power over the past two decades for schools included in the sample. Additionally, overall enrollments at the sample institutions increased by just over 16 percent in this timeframe.¹⁴ This shows that not only did the net cost that students paid on average increase, it did so while more students competed for the aid resources available. This would suggest that individual students were either likely to see lower grant aid awards on average or that a smaller proportion of the student population was able to receive governmental aid.

Additionally, and again consistent with the literature, institutional aid among the sample of schools used here has increased at a greater rate than federal or state aid. In 2009, the schools in

¹⁴ The University of Texas is not included in this figure because of its much higher enrollment numbers.

the sample offered over \$107 million on average to students. This reflects an inflation-adjusted increase of more than 401 percent over 1987 (See Figure 3).

Figure 4



Source of data: DCP 1987-2009. Instructional expenditures per student were calculated by taking total university expenditures on instruction and dividing by total enrollment. Both expenditures per student and in-state tuition shown here represent the average of the 14 universities in the subsample for the given year.

As a final consideration regarding financial aid, debt levels among students at the 14 institutions also saw increases. While data from the DCP is only available beginning in 2000, some noticeable trends emerge for the time period for which data is provided. For first-time, full-time undergraduates, an average of 6.1 percent more students took out loans to help finance their education in 2009 than did 10 years earlier, totaling 39.1 percent.¹⁵ The total average amount for students who did take out a loan for a given school year increased by about 54 percent over the 10-year period after adjusting for inflation, rising from \$3,905 to \$6,020. By comparison average

¹⁵ This statistic pertains only to first-time, full-time undergraduates. Students who are either returning to school, have transferred, or do not attend full-time (usually defined as 12 or more credit hours in a single semester) are not included in this figure.

CPI-scaled tuition at the 14 institutions increased by roughly 68 percent for in-state students and 101 percent for out-of-state students in the same timeframe.

So while establishing that students in general were paying approximately three times more in 2009 than they were two decades prior, university expenditures related to their instruction did not see similar increases. Over the given period, instructional expenditures per student increased over 20 percent on an inflation-adjusted basis¹⁶. This figure is less than the increase in the real net cost students experienced over the same time period, meaning that a greater proportion of tuition revenues were funneled away from classroom expenditures (See Figure 4). Part of this change can likely be explained by the fact that tuition revenue began to constitute a greater proportion of total revenue for the universities over the 22-year period, but it also shows that increases in instructional quality were unlikely to increase at the same rate at which costs to students did.

The two important measures contained in Figure 5 that have not already been discussed are total enrollment and standardized test scores. Matching the national trend, enrollments at all 14 universities grew over between 1987 and 2009. Excluding the University of Texas because of their much larger size, enrollments increased on average during the time period by more than 10 percent. As these enrollments increased, there was a not a sizable increase in the peer ability of incoming students. Standard deviations for both ACT and SAT mean scores were relatively low and did not vary significantly over time, indicating a relatively stable level of quality for the institutions of study.

¹⁶ This inflation adjustment was made using the HEPI rather than the CPI. While the CPI reflects price increases in consumer goods and services in the market, the HEPI looks specifically at price increases in the inputs universities account for in their budgets and is therefore a more appropriate measure when considering costs incurred by universities in providing education to students.

Figure 5

Variable	Obs.	Mean	Std. Dev.	Min	Max
Academic year	322	1998	6.644	1987	2009
Total enrollment	322	48710.22	34163.79	19809	200038
Federal grant aid (in millions of 2009 \$)	322	32.823	29.71	8.724	219.09
State grant aid (in millions of 2009 \$)	313	17.168	16.12	0.028	91.153
Unfunded institutional grant aid (in millions of 2009 \$)	318	28.283	33.507	0.024	230.3
Revenue from state appropriations (in millions of 2009 \$)	322	548.738	332.793	198.067	2261.966
In-state tuition and fees (in 2009 \$)	321	4777.154	1998.353	1512.14	10690
Out-of-state tuition and fees (in 2009 \$)	321	14671.73	4847.428	5765.682	29243
Average loan amount (in 2009 \$)	140	4506.508	974.859	2814.632	8155
Percentage taking loans	140	35.7	9.193	17	77
Educational expenditures per student	322	17185.55	6174.152	8524.021	40214.55
ACT composite (25th percentile) ¹⁷	93	22.995	1.468	20	26
ACT composite (75th percentile)	93	28.146	1.318	26	31
SAT math (25th percentile) ¹⁸	104	563.221	31.399	490	610
SAT math (75th percentile)	104	675.481	27.052	610	730
SAT verbal (25th percentile)	104	533.365	30.549	480	600
SAT verbal (75th percentile)	104	650	25.845	590	700

The empirical analysis begins by focusing on cost of in-state tuition as the dependent variable of interest. This regression was estimated four times, each time including or excluding the year and peer effects in order to track the differences in the results. Following this calculation, regressions were run including both peer and year effects in order to provide the most robust results possible.

Figure 6 shows the results for these first four estimations. It can be observed that the coefficients for federal grant revenue are much larger when not including the year fixed effects and are always positive, indicating a positive relationship in all four cases. The estimated coefficient on the state grant revenue becomes much more statistically significant when

¹⁷ ACT composite scores are out of a maximum of 36

¹⁸ Both math and verbal components are calculated with a maximum score of 800

Figure 6

Independent Variable	y1(1)	y1(2)	y1(3)	y1
	In-state tuition	In-state tuition	In-state tuition	In-state tuition
Federal grant revenue	40.367*** (6.319)	51.780*** (6.887)	4.771 (5.103)	10.282*** (3.357)
State grant revenue	-11.325 (7.163)	12.634* (7.0678)	-33.705*** (5.389)	-9.138*** (3.234)
Revenue from state appropriations	-4.739*** (0.597)	-2.0813*** (0.737)	-3.0157*** (0.487)	-0.383 0.0979
Total enrollment	0.0156** (0.00722)	-0.00198 (0.0210)	0.0296*** (0.00551)	0.00548 0.00941
Year Effects	No	No	Yes	Yes
Peer Effects	No	Yes	No	Yes
R2	0.251	0.572	0.120	0.400
Nobs.	312	312	312	312

(standard error)

*, **, ***=significant at the 10, 5, and 1% level

including the year dummies and are negative in three of the four estimations. This suggests that, contrary to the estimated coefficient on federal grants, revenue from state grants actually leads to lower tuition. The estimated coefficients for both federal and state grant revenue indicate that an increase in each by \$1 million will result in nearly no change in tuition costs. Revenue from state appropriations is highly significant until both year and peer effects are included in the estimation. The total enrollment variable is also insignificant when the year and peer effects are included in the regression. Surprisingly, the R^2 term over these four regressions is highest when the year effects are not included.

Figure 7 provides the coefficient estimates and stand errors for the dependent variables that relate to cost and debt. The estimates provided in the first column of Figure 7 are the same as the final column from Figure 6, but are included again here so that results can be compared

among the different variables of interest. With respect to out-of-state tuition at the 14 universities, revenue from federal and state grants are significant, but to a lesser extent than the

Figure 7

Independent Variable	y1	y2	y3	y4	y5
	In-state tuition	Out-of-state tuition	Institutional grants	Average loan amount	Percentage of students obtaining loans
Federal grant revenue	10.282*** (3.357)	17.524** 7.705	0.518*** (0.093)	20.610* (10.776)	-0.0675 (0.0741)
State grant revenue	-9.138*** (3.234)	12.688* (7.423)	-0.502*** (0.089)	-2.689 (4.609)	-0.0371 (0.0317)
Revenue from state appropriations	-0.383 (0.398)	-2.621*** (0.913)	-0.0122 (0.0110)	-0.393 (0.746)	0.00194 (0.00513)
Total enrollment	0.00548 (.00940)	-0.0132 (0.0216)	0.000846*** (0.00026)	-0.0335 (0.0229)	0.000462*** (0.000157)
Year Effects	Yes	Yes	Yes	Yes	Yes
Peer Effects	Yes	Yes	Yes	Yes	Yes
R2	0.396	0.236	0.603	0.302	0.788
Nobs.	312	312	309	134	134

(standard error)
*, **, ***=significant at the 10, 5, and 1% level

are for in-state costs. The estimated coefficients indicate that there is a positive relationship between out-of-state tuition and both federal and state grant revenue, suggesting that out-of-state costs increase and these revenues increase. In contrast to in-state tuition, however, revenue from state appropriations is highly statistically significant and negative with respect to out-of-state tuition. Enrollment was also statistically insignificant for out-of-state tuition.

For institutional grant expenditures, both federal and state grant revenues were significant. Like the estimated coefficients on in-state tuition, those on institutional grants had opposite signs and were nearly equal in magnitude, suggesting that \$1 of federal grant revenue and on dollar state grant revenue would largely cancel each other out with respect to their effects

on institutional aid levels. Revenue from state appropriations was statistically insignificant, but enrollment was highly significant.

For both measures of debt included in this analysis—the average loan amount taken out by students in a given year and the percentage of students who took out by undergraduates—had values that were mostly insignificant. Revenue from federal grants was the only statistically significant measure with respect to the average loan amount; it was significant at the 10 percent level. For the percentage of students obtaining loans, total enrollment at the university was the only significant variable.

Figure 8

Column1	y6	y7	y8	y9	y10	y11	y12
	Educational spending per enrolled student	ACT composite score (25th percentile)	ACT composite score (75th percentile)	SAT math score (25th percentile)	SAT verbal score (25th percentile)	SAT math score (75th percentile)	SAT verbal score (75th percentile)
Federal grant revenue	0.581 (6.402)	-0.0167 (0.0172)	-0.0261** (0.0130)	-0.722*** (0.264)	-0.369** (0.184)	-0.470* (0.245)	-0.404** (0.197)
State grant revenue	-11.0226 (7.854)	0.0206* (0.0120)	0.0203** (0.00911)	0.186* (0.106)	0.0698 (0.0741)	0.206** (0.0989)	0.158** (0.0795)
Revenue from state appropriations	-0.596 (1.0582)	0.00202* (0.00111)	0.00166* (0.00085)	0.00721 (0.0162)	-0.00165 (0.0113)	-0.000734 (0.0150)	-0.00793 (0.0120)
Total enrollment	-- (0.000046)	0.000082* (0.000035)	0.000106*** (0.000035)	0.00182*** (0.000515)	0.00110*** (0.000359)	0.00131*** (0.000479)	0.00098** (0.000385)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peer Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.0084	0.831	0.853	0.848	0.919	0.830	0.882
Nobs.	313	88	88	99	99	99	99

(standard error)
*, **, ***=significant at the 10, 5, and 1% level

Figure 8 contains the coefficient estimates and standard errors for the remaining variables of interest included in this analysis. Both educational expenditures per student and standardized test scores are traditionally perceived as proxies for educational quality at an institution. Total enrollment was not included in the estimation for educational spending per student because total

educational expenditures were divided by enrollment to calculate the measure. None of the other three measures included in the regression were statistically significant. The coefficient estimates that relate to test scores of incoming freshman vary in statistical significance. As a general trend, federal aid revenue tended to be statistically significant with negative coefficients, indicating that awards like Pell grants had a tendency to decrease the average ability of an incoming freshman class. In contrast to federal aid, state aid revenues yielded positive coefficients, thereby suggesting an increase in ability as the university received more state aid revenues, although these tended to be less statistically significant. Revenue from state appropriations was only weakly significant with respect average ACT scores; all other measures related to state appropriations were not significant. Finally, total revenue was by far the most significant of the quality estimations. In general, peer ability tended to increase as enrollments increased. With that said, it should be noted that the explanatory power of the peer academic ability measures, despite very high R^2 values, is quite limited because they contained few observations.

The results explained above, for the most part, follow reasonable expectations one might expect regarding their outcomes and there are several worthwhile points to be made. First, this analysis appears to lend some credence to the Bennett hypothesis. The results from Figure 7 indicate that for every increase of \$1 million in revenue from federal grants, in-state tuition can be expected to rise by approximately \$10 per student. In 2009, the average enrollment levels at the sample institutions were just over 45,000 students.¹⁹ Adding \$1 million in revenues to an institution of this size would mean that each student brings along with him average of just over \$22 per student. While this discussion will stop short of suggesting that a one dollar increase in

¹⁹ The University of Texas is excluded from this calculation because its enrollment numbers are substantially higher than the other universities, possibly because they reflect total enrollments across the entire University of Texas system rather than reflecting only enrollment at the Austin campus.

federal aid is accompanied by a \$0.50 increase in in-state tuition, that result would be consistent with existing literature (Gillen, 2012).

State grant revenue had a nearly opposite effect on in-state tuition. This is also consistent with existing literature regarding the effects of state-based financial aid programs (Long, 2004). Long (2004) explains in his discussion of the HOPE scholarship that institutions' decisions to not raise tuition when state-based grant programs award more financial aid is likely a political one. When state legislatures choose to invest more in these programs, legislators likely do not want to see the programs lose purchasing power as a result of increased costs. Therefore, increases in these programs appear to exhibit downward on pressure on tuition with similar force to the upward pressure caused by increases in federal grant aid programs. It is not entirely clear why state appropriations were not statistically significant in this estimation, but the negative coefficient related to state appropriations suggests that similar political pressure when the state increases funding may also exist.

Increased revenue from federal grants, state grants, and state appropriations all resulted in increased out-of-state tuition at the sample institutions. Pressures to keep costs low for out-of-state students are predominantly driven by market considerations rather than political ones. State-based grants are typically reserved for students who are attending a university in their home state and are provided by the government of that state. Therefore, one would expect that institutional and federal aid would constitute the aid packages awarded to students who are looking to go out of state to attend a university. When a university loses funding from the state, one lucrative source of alternative funding is out-of-state tuition. As a result, increases in state appropriations serve to create downward pressure on out-of-state tuition because universities are

less reliant on the more expensive tuition these students pay when they are adequately funded by the state legislature.

Like in-state tuition, revenues from federal and state aid programs exhibited equal and opposite effects on institutional grant expenditures. This inverse relationship between state and institutional grants is to be expected as both are predominantly merit-based awards. The positive relationship between federal and institutional grants could possibly be due to an external force not accounted for in the model, such as the cost of tuition. Tuition costs were not included in modeling because of endogeneity concerns. It is also to be expected that enrollment plays a statistically significant role in institutional grant levels because one can reasonably expect that as enrollments increase, levels of institutional aid will have to increase along with it, especially considering that loss in purchasing power of financial aid in the time period studied here (Doyle, 2010).

Federal and state-based grants, along with state appropriations, appear to have little, if any, effect on the number of students taking out loans to finance their education or on the amount of debt they take on in a given year. Despite large real increases in the amount of state-based and federal grants available to students to finance, this finding appears to validate the concern that the amount of aid available has not kept pace with increases in tuition and fees. One could reasonably expect that increases in the amount of aid funding would decrease the number of students taking out loans or the amounts of money those students are taking out in loans, but this is simply not the case.

A similar lack of statistical significance was found in the estimation for instructional expenditures per student. Figure 3 is helpful in interpreting these findings. Despite increases in cost and aid between 1987 and 2009, average instructional expenditures per student increased at

a much smaller rate on an inflation-adjusted basis.²⁰ This suggests that university budgetary decisions made regarding educational spending were likely made independent of the level of revenues in the form of grants.

Peer academic ability, as measured by standardized test scores of entering freshmen, was affected in most cases by federal and state grant revenues. State grants played a less significant role than federal grants and tended to increase quality of entering students as measured by these test scores while federal aid lessened quality. A likely explanation for this can be seen by exploring the different nature between the two types of aid. Most state-based grant programs are based on merit are used as an incentive to keep high-performing students in the state rather than increase access. On the other hand, federal aid is almost entirely need-based and its requirements are based on institutional costs and expected family contribution. As a result, when an institution receives more in federal aid, it signals that more students from lower-income households are attending the institution, and lower-income students in general tend to not perform as well on standardized testing. On the other hand, if a school is receiving more state aid revenue, it signals that more meritorious students are attending the institution and peer ability will be expected to climb.

With respect to quality metrics, state appropriations appear to have little influence on the academic caliber of incoming students. Enrollments, however, do appear to have some effect, with more students in attendance increasing the overall ability of the student body. The reason for this is not completely clear, but it may have something to do with the selectivity of the institution. Further data on acceptance rates would need to be assessed in order to answer this question completely.

²⁰ It is useful to mention here again that educational expenditures were adjusted for inflation using the HEPI Index in lieu of the CPI.

Now, having discussed the results of the estimations, there are a few points to be made regarding the shortcomings of this analysis. First, there is a possibility the model is misspecified. For example, while OLS with fixed effects appropriate to use when analyzing panels of data, like the DCP, another estimation strategy like a logit model may have been more precise in explaining the causal relationships that have been described in this paper. While there is nothing to necessarily suggest that the OLS strategy employed here was incorrect, it is possible that it is not optimal in this case.

Second, this analysis may suffer from an omitted variables bias. As briefly mentioned above, there were several measures that could have added to the explanatory power of the model that were not, either because they were not included in the DCP dataset, they were included but were not numerous enough to provide a reliable analysis, or the values for particular measures were suspicious as to their reliability so they were omitted. Not including these other measures leaves the potential for biased coefficients because it is possible that certain observed effects are being attributed only to the variables that are included when they are actually the effect of another effect that is not included in the model. This is indeed possible, but every step was taken to ensure that the estimates provided here are as reliable and robust as possible with the data that was available.

Third, the sample analyzed in this exercise is comprised of only 14 institutions. While these institutions are appropriate for comparison against each other due to similar size, research, and land-grant status, they may not be representative of public universities as a whole. Had more institutions been included in the analysis, estimates on the direct effect of increases in aid revenue would have been improved.

Finally, there is also some measurement error in this analysis. While as much care as possible was taken to remove any problematic variables or observations that were clearly incorrect, working with large datasets like the DCP is likely to allow some to be included in the final analysis. While this error may be present, the results presented in this paper are consistent with the body of literature that has come before it, suggesting that any error or bias included in the model did not affect the outcome in a manner that would make the estimates unreliable overall.

VII. Conclusion

Over the course of this analysis, attention has been paid to the market for higher education and the role that student financial aid plays in it. American higher education finds itself in a predicament. New opportunities for innovation are emerging in fields like information technology and healthcare. As a result, demand for skilled workers to fill jobs in these sectors is increasing. While countries like China and India are emerging as leaders in their ability to produce educated workers, American students are finding that their path to obtaining a degree is more difficult due to costs increasing at rates higher than that of inflation. Financial aid as a policy tool has the potential to not only mitigate these costs for students, but also provide incentives for them to work harder before reaching college and once there, benefit from the increased academic caliber of their peers who did the same. However, if the effects of financial aid revenue in the form of state and federal grants are failing to actually reduce costs and improve quality, a reassessment of national educational goals and best practices to achieve them is warranted.

The results of this analysis suggest that financial aid revenue does, in some cases, cause tuition for students to increase. This means that some credence should be given to the Bennett

hypothesis, which suggests that institutions increase their costs in response to increases in funding to federal aid programs. There are a number of implications to these results that should be taken into account by policy makers.

First, the question of accessibility to these institutions is a complicated one. While federal aid programs are instituted to increase the opportunity for prospective students to attend a university, increasing costs as a result of additional revenues created by these programs mean that there will be some students who slip through the cracks. Expectations of financial aid awards vary for each individual and if students either do not expect to receive enough in grants or scholarships, or are ignorant of the many different aid programs that exist, increased tuition will deter many more students than if tuition remains low. As suggested previously, there needs to be communication and coordination among federal and state governments with institutions to ensure that the influx of additional aid revenue is not negated by cost increases. President Obama's call to universities to keep costs low may be the first step in launching this dialogue.

Also, in a fashion representative of national trends, none of the universities studied in this analysis saw a decrease in tuition between the late-1980s and today. While funding for aid programs fluctuates with changes in governmental revenue and trends in the macro-economy, costs go nowhere but up. Federal legislators, as well as their constituents, would be wise to take account that the decision to increase financial aid funding causes upward pressure on the costs to attend a university that cannot (or simply has not) been undone. When more aid is provided, universities can be expected to increase their costs somewhat as a result, but a reduction or elimination of funding for an aid program will not be answered by institutions by lowering costs. Therefore, the decision to provide financial aid to students should be a long-term commitment if these policies are indeed intended to make college more affordable; taking away aid funding will

simply result in higher costs of attendance due to price increases that take place when the funding is available.

With respect to the effect of grant aid on quality, this analysis is unfortunately unable to offer a definite conclusion as to whether or not these programs are effective in increasing quality due to limitations in the data resulting from small sample sizes. Despite this, further analysis may be directed to determine precisely if financial aid has been able to increase quality of the educational experience offered by institutions in the U.S.

Overall, these results appear to offer enough to encourage renewed dialogue regarding the American higher education system and whether or not the proper policies are currently in place to ensure that enough people are able to obtain training in emerging fields to meet demand. If the U.S. fails to meet this demand, some developed and developing nations have shown that they have the commitment and resources necessary to train the workers that the U.S. cannot, signaling that the era of American global economic dominance may be nearing its end of prevailing trends are not reversed.

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