DISCUSSION PAPER SERIES

IZA DP No. 3827

Rising Tuition and Enrollment in Public Higher Education

Steven W. Hemelt
Dave E. Marcotte

November 2008

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Rising Tuition and Enrollment in Public Higher Education

Steven W. Hemelt
University of Maryland, Baltimore County

Dave E. Marcotte
University of Maryland, Baltimore County and IZA

Discussion Paper No. 3827
November 2008

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 3827
November 2008

ABSTRACT

Rising Tuition and Enrollment in Public Higher Education*

In this paper we review recent trends in tuition at public universities and estimate impacts on enrollment. We use data from the Integrated Postsecondary Education Data System on all public four-year colleges and universities from 1991 to 2007 and illustrate that tuition increased dramatically beginning in the early part of this decade, increasing at rates unprecedented in the past half century. We examine impacts of these tuition increases on total enrollment and credit hours, and estimate differences by type of institution. We estimate that the average tuition and fee elasticity of total headcount is -0.1072. So, at the mean a $100 increase in tuition and fees (in 2006 dollars) would lead to a decline in enrollment of a little more than 0.25 percent, with larger effects at Research I universities. We find no evidence that especially large increases from one year to the next have a disproportionately large negative effect on enrollment.

JEL Classification: I2, I21, I23

Keywords: higher education, tuition, enrollment

Corresponding author:

Dave E. Marcotte
University of Maryland, Baltimore County
Department of Public Policy
1000 Hilltop Circle
Baltimore, MD 21250
USA
E-mail: marcotte@umbc.edu

* We are grateful to Tim Brennan, Mark Duggan, Doug Lamdin, and seminar participants at UMBC and the American Education Finance Association (2008) meetings in Denver for helpful comments and suggestions. Of course, any errors and all opinions are our own.

Over the course of the past few decades, the cost of higher education at public colleges and universities has risen rapidly. Adjusting for the availability of state and federal financial aid, growth in the costs of higher education has outpaced inflation and even health care. The rise in tuition has been driven by a number of factors, including a pervasive trend in the use of cost offsetting in public higher education (Johnstone, 2004), and real and even nominal declines in appropriations due to state revenue shortfalls (Koshal & Koshal, 2000; Rizzo & Ehrenberg, 2003). By late 2008, with economic conditions weakening and financial pressures on state budgets growing, the *New York Times* was reporting that college tuition is likely to go up at an even faster rate (Lewin, 2008).

As fiscal pressures have mounted, college and university administrators and their governing boards have been forced to offset declines in non-tuition sources of revenue. Naturally, they face substantial pressure to increase tuition. While administrators and analysts are aware, at least at some level, that demand schedules are downward sloping, the implicit assumption among many higher education administrators seems to be that tuition elasticity of enrollment is tolerably small: So, that any enrollment decline will be small enough that net revenues will rise with the higher tuition. More generally, an important concern is whether rising prices are making higher education less affordable. If so, beyond the implications for institutions, the recent period of fast-rising tuition may have the effect of limiting educational attainment in the aggregate.

Unfortunately, evidence on how enrollment responds to the rising costs of higher education is not conclusive, and much of the empirical work is not recent. Previous work by economists reaches mixed conclusions about how sensitive enrollment is to tuition increases. To a large extent the range of estimates is due to differences in empirical specification, or to the fact

that many studies are limited to individual institutions. But even general studies largely pre-date the recent period of rapid increases in tuition.

In this paper, our first objective is to update estimates of the price elasticity of enrollment in public education. Using data from the Integrated Postsecondary Education Data System (IPEDS) on all four-year institution from 1991 to 2007 we estimate enrollment responses to tuition increases. We examine the impact of price changes on several measures of enrollment: total headcount, total number of credits taken, and the number of first-time, full-time freshman (FTFT). As we describe below, the first of these measures is likely to be the slowest to respond, but clearly an important measure of demand for any institution.

A second objective derives from an important aspect of inter-temporal patterns of tuition at public institutions. While tuition levels can vary substantially across institutions within a state, as we illustrate below, tuition patterns over time are quite similar across institutions within states. Though tuition may be rising in similar ways across various public institutions, the markets they serve can be quite dissimilar. Public institutions are diverse, with different missions, and students. As an example, though in the same state, the University of Michigan in Ann Arbor and Lake Superior State University differ along many dimensions important for understanding comparative statics of price changes.[1] Because of variety in the education and experience colleges and universities provide students, and because of differences in the financial resources of the average student across institutions, enrollment responses to price fluctuations may vary. So, one of our goals is to assess the degree to which the impact of tuition increases on enrollment varies at different types of institutions.

Finally, we examine the impacts of exceptionally large tuition increases on enrollment. Recent declines in non-tuition revenue have forced administrators at public colleges and

[1] Nonetheless, the correlation coefficient on inter-temporal variation in tuition at these institutions is 0.984.

universities to adopt unusually large tuition increases. To give some sense of the magnitude of the tuition increases recently implemented across the country, during the early part of the decade as states grappled with fiscal crises, the University of Arizona increased real tuition from $2,700 to $3,697 for a full-time in-state student in 2004. The same year, the University of Massachusetts-Lowell increased tuition from $5,468 to $7,530. Changes like these not only raise public awareness of the rising cost of higher education, but also make more import the task of updating estimates of enrollment impacts. One question we address is whether large, abrupt changes in tuition like these have disproportionately large effects on enrollment.

In the next section, we briefly summarize recent work on the relationship between tuition costs and enrollment in higher education in the U.S., and summarize recent trends in tuition. We then describe our empirical objectives and estimation strategy, along with the IPEDS data we employ. We then turn to our examination of patterns of tuition and enrollment in four-year public colleges and universities during the past two decades. We focus not only on average impacts and basic revenue implications, but also explore the degree to which student response differs across types of public institutions.

1) Background

Economists and other analysts have long been interested in understanding the demand for higher education. Examples of such work include studies focused on quantifying price elasticities for various student populations, estimating student sensitivity to changes in financial aid packages, or constructing university-specific demand functions.

Much of the early work on the demand for higher education was reviewed by Jackson and Weathersby (1975). Using the parameters estimated in a number of studies, they concluded that the net behavioral response to changes in tuition is modest: Between a 0.05 and 1.46 percent

decrease in enrollment ratio per each $100 increase (1974 dollars) in student cost. Additionally, they found the absolute magnitude of price responsiveness to decrease with income. In a meta-analysis of studies completed between 1967 and 1982, Leslie and Brinkman (1987) similarly concluded a $100 tuition price (1982 dollars) increase to be associated with a 0.6 to 0.8 percentage point decline in college enrollments.

Heller (1997) provides an update to Leslie and Brinkman. He concludes that a $100 increase results in a 0.5 to 1.0 percent decline in enrollments. But, he points out that the empirical work he examined used data from the 1970s and 1980s, so the effect might not generalize to the higher tuition levels at the time of his analysis (p. 650). A decade after Heller's analysis, tuition has climbed higher, still.

While much of the initial work on enrollment responses to tuition were institutional demand studies, several papers examined national-level data. For example, Kane (1994) and St. John (1990) used the High School and Beyond (HSB) data (which followed a sample of students who were high school sophomores and seniors in 1980), and estimated that enrollments fell by approximately one half to one percent with a $100 increase in tuition. Rouse (1994) used data from the National Longitudinal Survey of Youth (NLSY), a cohort contemporary to the HSB students, and found that an 8 percent increase in tuition resulted in a decline in enrollments of between two-thirds to one percent. Most relevant to our empirical work, Heller (1996) and Kane (1995) used data from the IPEDS for the 1980s and early 1990s. In both cases they find that a $100 increase in tuition at four-year institutions results in a decline in enrollment of just under one half percent.

These previous studies have all used data from about a decade or more ago. In the meantime, tuition has continued to rise, and by a lot. Figure 1 shows the increase in tuition costs

from 1991 to 2007 compared to the increase in the inflation rate, as measured by the CPI-U. Clearly, tuition costs are rising substantially, and the rate of increase accelerated recently. Additionally, tuition rose at comparable rates at research-intensive universities, comprehensive universities, and liberal arts colleges.

The time series of average tuition in Figure 1 does not illustrate two important stylized facts about recent changes in tuition relevant to our work. First, the distribution of year-to-year real tuition increases is positively skewed. The mean annual increase in real tuition during the period we study is 4.2 percent. But, a number of institutions implemented much larger real year-to-year hikes. In Figure 2 we present the frequency distribution of real year-to-year tuition increases for all public four-year colleges and universities from 1991 to 2007. While many of these year-to-year hikes are in the neighborhood of 4 or 5 percent, a considerable number are above 10, 15, and even 20 percent.

The second important fact about recent changes in public higher education costs is that while there are markedly different inter-temporal changes in tuition across states, within states trends in tuition are generally similar across the various types of four-year institutions. So, while Figure 1 illustrates that at the national level patterns of average changes in tuition are similar for various types of institutions, we find the same thing within states. We illustrate this in Figure 3, which shows the time series of real tuition (indexed to 1991) at public Research I, Research II and Comprehensive universities in the four most populous states in the U.S. Generally, tuition increases are comparable across institution types.

Our objective is to understand how these recent tuition increases affect demand for education at public four-year colleges and universities. As with any good or service, price increases like these could arise because supply has shifted. But, there is no evidence of an

upward shift in supply: The number of public four year institutions has increased only modestly over the past decade, from 622 in 1997 to 638 in 2006.[2] In any case, because we focus on four-year public institutions, it is important to recognize that the processes that set price here do not necessarily adhere to market principles. In previous studies, researchers have found that much of the within institution variation in tuition at public universities appears to be driven by fluctuation in state appropriations (Koshal & Koshal, 2000; Rizzo & Ehrenberg, 2003). Further, (Lowry, 2001a and 2001b) presents empirical evidence that these factors determining fluctuation in state appropriations are exogenous to the process shaping enrollment demand.

Evidence from the IPEDS, too, suggests that state appropriations drive pricing decisions at four-year institutions. As an illustration, consider again those large tuition increases in the upper tail of Figure 2. In Figure 4 we present a frequency distribution of the number of tuition hikes of 15 percent or more at public four-year institutions over the course of our panel. Superimposed on this distribution is a time series of the mean of de-trended logged real state appropriations received by these institutions in each year, net of institution fixed effects. If the average institution's revenue growth followed the national trend, this line would be flat, at zero. In years where institutions receive real appropriations in excess of their normal appropriation (de-trended), the series is positive. In bad years (lower appropriations than typical), the series is negative. Clearly, real state appropriations were around four percent below typical levels in the early part of this decade, when most of the large year-to-year tuition hikes occurred. During the late 1990s, when appropriations were relatively high, there were few large tuition increases. Our

[2] NCES. (2008). *Career/Technical Education Statistics*, Table P71: "Number of postsecondary undergraduate institutions, overall, and those awarding career education credentials, and percentage of Title IV postsecondary undergraduate institutions awarding career education credentials, by control and level of institution: United States 1997 to 2006."

reading of these patterns is that large tuition increases at public colleges and universities track changes in state appropriations.

On the demand side, there are a number of factors relevant for understanding the enrollment consequences of tuition increases. An obvious consideration is that price increases may be driven by shifts in the demand curve, making hazardous any interpretation of a tuition enrollment tradeoff as an estimate of elasticity. Bound and Turner (2006) provide evidence that over the last half century large cohorts of college age students faced higher net costs and subsequently lower rates of undergraduate degree attainment. We focus here on a much shorter period, for which these demographic shifts can have a limited role, if any. Further, all our empirical models include year fixed effects. To the extent that there were important shifts in the number of persons of college age, or applying for college, within our panel, these year effects will pick up any common effects on enrollment demand. More important for estimating demand elasticity are matters of model specification that control for quality differences, income, labor market conditions, and prices of substitutes. We discuss these issues below.

2) Data and Methods

In order to investigate student response to tuition increases at U.S. public universities, we use IPEDS data from 1991 to 2007. The IPEDS is an institution-level data set, and we use data on all of the more than 600 four-year public institutions across the entire United States. We focus on four-year public universities because the vast majority of students at four-year colleges and universities attend public intuitions. In 2003-2004, public universities enrolled 69 percent of all undergraduate students enrolled at four-year institutions.[3] Further, as a matter of public policy, demand functions at public institutions are of primary concern.

[3] NCES. (2005). *Digest of Education Statistics,* Table 319: "Undergraduates enrolled full time and part time, by aid status, source of aid, and control and type of institution: 2003-04."

IPEDS is the main postsecondary education collection program from the National Center for Education Statistics (NCES). It is a system of survey components designed to collect data from all organizations whose primary purpose is to provide postsecondary education. IPEDS contains a compilation of institutional-level data on: enrollment, program completion, faculty size and salaries, staff, institutional prices, and other institutional characteristics.[4] IPEDS provides three different yearly measures of enrollment: total undergraduate unduplicated headcount, total undergraduate credit hours, and the number of entering first-time full-time freshman (FTFT). While the first two measures are available for the majority of our panel, the FTFT measure is only available from 2001-2002 to 2006-2007.

The Bureau of Labor Statistics reports on many key national and regional economic indicators. We utilize yearly state unemployment rate statistics from the BLS, personal income measures by state from the U.S. Bureau of Economic Analysis, and data on state populations from the U.S. Census Bureau.

For our panel, we estimate log-log models of the following general type:

$$\ln(EN_{it}) = \beta_T \ln(T_{it}) + \beta_A \ln(id_{it}) + \beta_{HS} HSgrads_{st} + \beta_{CP} CP_{st} + \beta_I \ln(Inc_{st}) + \beta_P Pop_{st} + \beta_U Un_{st} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (1)$$

Where EN_{it} is a measure of enrollment in institution *i* in academic year *t.* We use three different measures of enrollment: the 12-month unduplicated headcount of all undergraduates enrolled; the total number of credit hours; and the number of first-time full-time freshmen. Because students can adjust credit hours and freshman enrollment more readily at the margin, we anticipate total headcount to be the least responsive to price changes.

[4] National Center for Education Statistics. "About IPEDS." Access: http://nces.ed.gov/ipeds/AboutIPEDS.asp

The key independent variables include T_{it}, a measure of in-state tuition and fees charged to full-time students attending institution *i* in year *t*.[5] We employ log-log specifications for ease of interpretation and because of improved model fit. Aid_{it} is a vector of two measures: total Pell grant dollars disbursed or otherwise made available to recipients by the institution, and the total gross amount of scholarships and fellowships awarded. Student aid is an important mechanism for reducing the real price of post-secondary education. Among full-time students attending four-year public institutions, about 76 percent reported receiving some kind of financial aid during the 2003-04 academic year.[6] Further, the proportion of full-time students utilizing institutional aid has increased from 17 percent in 1992-1993 to about 23 percent in 1999-2000. Over this same period, the average amount of aid received by these students increased (in constant 1999 dollars) from $2,200 to $2,700 (Horn and Peter, 2003). Indeed, public institutions faced with implementing large tuition increases might attempt to offset those costs by making larger financial aid offers or better facilitating the ability of students to apply for federal aid or subsidized loans (Marklein, 2002).[7]

We include a number of controls to capture institution and state-level factors that affect enrollment for a given institution and over time. $HSgrads_{st}$ is a measure of the number of high school graduates in state *s* in academic year *t*. CP_{st} is a vector of competitors' prices, including: average community college tuition and fees and average four-year private university tuition and

[5] We deflate all monetary values to 2006 dollars using the CPI-U.
[6] NCES. (2006). *Digest of Education Statistics*, Table 327: "Percentage of full-time, first-time undergraduates receiving aid, by type and source of aid received and control and type of institution: Selected years, 1992-93 through 2003-04."
[7] The role of aid is not entirely clear. Even in the presence of financial aid to help reduce costs, students are likely to respond first and most strongly to the "sticker price" of attendance. Beyond this, decisions about some types of financial aid come much too close to the time students must make actual attendance decisions. Further, many students do not even apply for financial aid due to the complicated nature of the forms and process (Dynarski and Scott-Clayton, 2006).

fees in state *s* in year *t*. Inc_{st} and U_{st} are measures of average per capita income and the unemployment rate for state *s* in year *t*, respectively. We include these to control for economic and social conditions that could potentially affect both enrollment numbers as well as the opportunity costs students face.

We include institution-specific fixed effects (α_i) and year effects (α_t). By including school-fixed effects, we use within-institution variation over time in tuition and fees to estimate enrollment effects, net of common year effects. To account for the possibility of serial correlation in the error term, we cluster standard errors at the institution level.[8]

To this basic set-up, we carry out two main extensions. First, we estimate this general model separately by Carnegie classification of institution.[9] The strategy to identify effects of tuition changes on enrollment described above will provide the average within-institution effect for a group of heterogeneous institutions: Large research-intensive and doctoral granting universities, comprehensive teaching universities, and small liberal arts colleges. Not only do these institutions vary in size and mission, their students may vary in their sensitivity to price changes. Further, the importance of tuition as a source of revenue varies across institution type.[10] Hence, the ability to provide learning, campus activities, or services to students may be more sensitive to fluctuations in tuition revenue at comprehensive universities and liberal arts colleges, than at research-intensive universities.

Second, we examine whether enrollment following especially large year-to-year tuition hikes falls, over and above the enrollment response resulting from the tuition increase itself.

[8] We also estimate models in which we cluster on state, because of the substantial relationship between inter-temporal patterns of tuition across institutions within states. Standard errors from models clustered on states were indistinguishable from models clustered on institutions.

[9] Carnegie Foundation for the Advancement of Teaching. (2006). "Basic Classification Technical Details." Access: http://www.carnegiefoundation.org/classifications/index.asp?key=798

[10] NCES. (2005). *Digest of Education Statistics,* Table 330: "Current-fund revenue of public degree-granting institutions, by source of funds and type of institution: 2000-01."

Especially large tuition increases from one year to the next might elicit a response from students, over and above a scaled-up response to a more modest tuition increase. Students may view large tuition hikes as unfair, out of line with previously established norms, or even violating an implicit contract once enrolled. Large tuition hikes may also signal that a school is performing and planning poorly, in dire financial straits, or as an indication of price changes to come. Or, very large year-to-year tuition increases may have disproportionately large enrollment effects because families planning and saving for college may not be able to adjust long-term financial planning to accommodate abrupt price changes.[11]

To examine if large tuition increases have proportionately more impact on enrollment than small hikes we modify the specification of our empirical model. In the augmented model, described in Equation 2, in addition to the contemporaneous direct measure of tuition and fees, we include a separate vector of dummies defined around a large hike in tuition at institution *i* *($Hike_{it}$)* between year *t-1* and year *t.* If large hikes have proportionately no more impact on enrollment than smaller tuition increases, β_T will capture the entire impact of the tuition increase. But, if large hikes elicit an enrollment response more than proportionate to their size, we expect $\beta_H < 0$.

$$\ln(EN_{it}) = \beta_T \ln(T_{it}) + \beta_H Hike_{it} + \beta_A \ln(Aid_{it}) + \beta_{HS} HSgrads_{st} + \beta_{CP} CP_{st} + \beta_I \ln(Inc_{st}) + \beta_P Pop_{st} + \beta_U Un_{st} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (2)$$

We explore various thresholds for determining what constitutes a large hike. But the basic idea is that we include an indicator equal to one if institution *i* hiked tuition between year *t-1* and year *t* in excess of some threshold (e.g. 10, 15, or 20 percent). Because students often enroll at an institution as freshmen with the intention of graduating from that institution, those

[11] There is evidence that families do not substantially adjust college savings plans in response to changes in financial aid incentives (Long, 2004; Monks, 2004).

already enrolled at the time of large increases may be less responsive to tuition hikes than prospective students. To see if the full effect of large tuition hikes develops over a few years, we include lags of the main hike dummy variables to capture the enrollment effect in years following large tuition hikes.

3) Results

3.1 Descriptives

We begin by considering descriptive statistics on enrollments, tuition rates, school-level characteristics, and state-level characteristics for our sample, presented in Table 1. Over the course of the panel, the average annual cost of in-state tuition and fees at four-year public universities was slightly under $4,200 (measured in 2006 dollars). Yet, there is large variation in public university tuition levels – ranging mostly between $1,400 and $11,000. Not surprisingly, the cost of tuition at public four public colleges and universities is between those at community colleges ($2,000) and four-year private universities ($16,500). Four-year public universities also vary widely in their enrollment numbers over the course of the panel – with a mean 12-month headcount of 10,700 (ranging from 400 to over 40,000 students).

As a way to begin to understand the relationship between tuition increases and enrollment, we consider patterns of enrollment before and after especially large tuition increases. In Figure 5 we present time series of enrollments, net of institution fixed effects, at institutions that made no large tuition hikes (over 15 percent) and at those that made one tuition increase of at least 15 percent, and those that made back-to-back hikes of at least 15 percent. To set up a simple difference-in-differences style comparison, we center the series for institutions with large hikes around the year of the first hike large hike (Year 0). To develop the counter-factual, we center the time series for institutions without large hikes in 1998, which was the mean year in

which these large hikes were implemented. There are interesting and suggestive differences in the patterns of enrollment in institutions making large tuition hikes compared to those that do not. Enrollment falls at institutions making large hikes after the first, second, and third years following large tuition hikes, relative to those without such large tuition increases. Further, the decline in enrollments is even more pronounced for those institutions that introduce two large tuition hikes. Interestingly, enrollments grow faster initially for institutions that later adopt large tuition increases.

3.2 Multivariate Results

To more fully consider the relationship between tuition increases and enrollment, we present results from our first set of empirical models in Table 2. The columns present the results of our basic specification on each of the three measures of enrollment described above. In columns 1, 2, and 3, respectively, we present estimates of the effect of tuition on total enrollment, total credit hours, and enrollment of first-time full-time freshman students (FTFT). All of these models include controls for state characteristics, institution fixed effects, and year effects.

We estimate that the average tuition and fee elasticity of total headcount is -0.1072. Evaluated at the means (approximately $4,200 tuition and enrollment of 10,700) a $100 increase in tuition and fees would lead to a decline in enrollment of approximately 27 students, or a little more than 0.25 percent. This estimate is quite similar to Kane (1995), who uses state level data for the 1980s and early 1990s, who estimate that a $100 increase in 1991 dollars results in an enrollment decline of just under one-half percent. In comparable dollars, we estimated a decline of just under 0.40 percent.

The tuition elasticity of credit hours is essentially identical (column 2). The enrollment response of freshmen is larger (column 3). This is expected, since students who have not yet matriculated may be most able to change enrollment decisions in response to price changes. But, the difference between the tuition elasticities of total headcount and freshman enrollment is not significant at conventional levels.

The cross-price elasticity of private college tuition is of the expected signs, and as before it appears that freshmen are more responsive to price changes at the margin. The average within-state tuition at two-year institutions is negatively related to enrollment at four-year institutions. This is not expected if these institutions are substitutes, but the magnitudes here are very small and always insignificant.

3.3 Results by Institution Type

We next turn to the question of whether the enrollment response of tuition changes is different for different types of public universities and colleges. In Table 3 we present results of models identical to those in Table 2, but estimated separately for Research I, Research II, Comprehensive, and Liberal Arts institutions. To fix ideas, Research I universities include the University of Wisconsin at Madison, Florida State University, and SUNY Stony Brook. Research II universities include Wichita State University, East Carolina University, and William and Mary. Comprehensive institutions grant fewer doctorate degrees but at least 50 Master's degrees. Liberal Arts colleges primarily grant undergraduate degrees. For example, the University of Michigan-Flint, San Jose State, and Montclair State are Comprehensive universities, while Evergreen State College, St. Mary's College of Maryland, and the University of Minnesota-Morris are Liberal Arts colleges.

A striking pattern emerges in comparing enrollment responses to tuition across institution types. The tuition elasticity of enrollment is largest at Research I universities. Enrollment also falls with tuition at Research II universities, but the elasticity of total headcount is about two-thirds as large as that at Research I schools. If we look at credit hours, tuition elasticities are quite similar. But, if the measure is enrollment of first-year full-time freshmen, enrollment is much more price responsive at Research I schools. For neither Comprehensive nor public Liberal Arts colleges are there significant negative enrollment effects of tuition increases.

Important for understanding the relative price sensitivity of enrollment at these different types of institutions, the average amount of aid available to students is least related to enrollment at Research I universities, and more important at Research II and Comprehensive institutions. How can a higher price sensitivity be reconciled with lower aid sensitivity at Research I institutions? Two factors seem relevant here. First, one clue lies in substantial intra-state correlation in tuition prices described earlier. Tuition increases within at Research I institutions are made alongside tuition increases at Comprehensive universities. A second relevant consideration is that these institutions serve different markets. Public Research I institutions are often state flagship schools, or universities with national reputations. These institutions compete with other public flagships and private universities and colleges. Research II and Comprehensives are typically less selective and may serve as substitutes for more price sensitive students within the state.

One way to examine this hypothesis for the relatively elastic price response of Research I institutions is to focus on the subset that most clearly have national reputations. One common source students use to compare and assess the prestige of various institutions is the annual “Best Colleges” rankings by U.S. News and World Report. We use these rankings to identify public

colleges and universities in the top 120 institutions in the nation.[12] We then re-estimate the models used to generate the results in Table 3, but split the sample into two different groups: the "top 120" group, and all other institutions.

Since top schools compete nationally for students, raising prices may come with more risk than schools whose competitors are other institutions in the same state/system, where relative tuition costs increase at about the same rate. If so, we would expect to see greater price sensitivity at "top 120" schools. We present these results in Table 4. In the first panel, we present estimates for "top 120" institutions. In the second panel we present results for all others. At the "top 120" schools, there is evidence that enrollment is more sensitive to tuition. The price elasticity of 12-month headcount and total credit hours are significant and substantially larger at top schools. Further, enrollment is less sensitive to aid at "top 120" schools than at other institutions. These patterns in price and aid sensitivity are consistent with students opting out of "top 120" schools for competitors as price rises, while finding a way to pay tuition bills at other state schools where students may have fewer options.[13]

The evidence from Tables 3 and 4 of higher price sensitivity but lower aid sensitivity at "top 120" and Research I institutions raises general questions about enrollment patterns at public four-year colleges and universities, beyond the implications of tuition on enrollment at single institutions. One implication may be a shift of students from higher income families to private institutions or public universities in other states, along with a shift of students from lower income families to less expensive public universities within the state.[14] This would suggest a

[12] We identified schools in our sample as being "top 120" by whether they appeared on the "Best Colleges 2000" list published in the August 1999 issue of U.S. News & World Report (which is approximately the midpoint of our panel).

[13] Further, using IPEDS data, we find that more FTFT students are out-of-in-state at Research I universities (20%) than at Research II (17.8%) and Comprehensives (15.2%).

[14] In our sample, the average cost of enrollment at a Research I university is $4837, compared to $4390 at Research II schools and $3869 at comprehensives.

redistribution of students across public colleges and universities within a state, with those most financially able leaving the system, and others scaling back to enroll at more affordable institutions. Obviously, student-level data are needed to test this.

3.4 Effects of Large Tuition Increases

Another way in which the average price response estimated in Table 2 may not be fully informative is the possibility the average conceals relatively large enrollment declines during years following especially large real tuition increases. To explore this, we present results in Table 5 from estimations using the set up described by Equation 2. In the first set of columns, we present results from models in which we augment the specification in Table 2 to include indicators of 1 if the tuition for the relevant institution in the observation year was at least 10 percent higher than the prior year, along with a series of lags. In the next three columns we present results for the same models where the threshold for what determines a large hike increases from a 10 to at least a 15 percent increase in real tuition.

The interpretation of the elasticities in the first row of Table 2 remains the same as in previous model. Regardless of whether we define especially large tuition increases to be above 10 percent or above 15 percent, the total enrollment falls by about -0.1 percent for each percent increase in tuition. Recall that the estimate from Table 2 comparable to the results in columns 1 and 4 here was -0.107. Were enrollment to fall off markedly following especially large tuition increases, we would expect to see negative coefficients on the indicator variables, increasing in absolute value. We see no such evidence.

Our interpretation of these patterns is that while the sharp tuition increases that made headlines in the early part of this decade can limit enrollment, their impact is no more substantial than a series of smaller tuition increases.

4) Conclusions

During the past decade, there have been exceptional and perhaps unprecedented increases in tuition at public colleges and universities. Poor economic conditions and subsequent state budget cuts have created a fertile landscape for large tuition increases. Those pressures have not abated. We survey the terrain of public higher education between 1991 and 2007 to update what is known about the relationship between tuition and enrollment. We make use of the variation in the timing and magnitude of sometimes very large tuition increases to examine patterns of enrollment.

An important empirical finding to derive from our work is that, despite increases in the rate of real tuition growth, there is no evidence that the tuition elasticity of enrollment in public four year institutions has increased. We estimate that the average tuition and fee elasticity of total headcount is -0.1072. So, at the mean a $100 increase in tuition and fees would lead to a decline in enrollment of a little more than 0.25 percent. This is quite similar to estimates of tuition elasticities from the 1980s and early 1990s (Kane, 1995; Heller, 1996).

Our estimates suggest that tuition can be used as a lever to offset revenue losses from declining appropriations. At the means of enrollment and tuition price, our results imply that a 5 percent increase in tuition (about $210) would result in an enrollment decline of about 57 students and the loss of about $250,000 in tuition from these students. But, the higher price charged to remaining students would bring in an additional $2.24 million in tuition revenue. So, if net revenue in the short run is the only concern for an institution, tuition is clearly a mechanism for augmenting revenue. Obviously, there may be political or other considerations important for public institutions that complicate this calculus.

We find no evidence that unusually large year-to-year tuition increases (e.g. – real increases in excess of 15 percent) have disproportionately large impacts on enrollments. While dramatic increases in tuition may make newspaper headlines, their impact is no more substantial than a series of smaller tuition increases.

We do, however, find substantial differences in enrollment responses at different types of colleges and universities. We find larger effects of tuition increases on enrollment at Research I and "top 120" public universities than we do at comprehensive universities and public liberal arts colleges. Moreover, enrollment is less sensitive to aid at Research I universities, and those in the "top 120" of the U.S. News and World Report rankings. At public colleges and universities of this type, it appears that the near-term consequence of increased tuition is a decline in enrollment. On the other hand, at comprehensive universities it appears that tuition increases don't necessarily mean lower enrollment, rather they mean more reliance on aid for the students who do enroll.

Institution-level panel data, like ours, are ultimately quite limited for the purposes of understanding consequences tuition increases on individual students, educational attainment, and on the public system of higher education more broadly. The enrollment responses at the institution level are consistent with softness in demand at the top tier of public colleges and universities. This could arise because students at these institutions view schools in other states, or private universities as substitutes. It could also arise because these schools are relatively expensive within state systems, and price increases induce some students to substitute to choose less expensive options with state. Of course, both of these explanations may be relevant for different sets of students.

References

Bound, J., & Turner, S. (2006). Cohort crowding: How resources affect collegiate attainment. *Journal of Public Economics,* 91(5-6), 877-899.

Dynarski, S. M., & Scott-Clayton, J. E. (2006). The cost complexity in federal student aid: Lessons from optimal tax theory and behavioral economics. *NBER Working Paper Series,* No. 12227.

Heller, D. E. (1996). Tuition prices, financial aid, and access to public higher education: A state-level analysis. Paper presented at the meeting of the American Educational Research Association (AERA): New York, NY.

Heller, D. E. (1997). Student price response in higher education: An ppdate to Leslie and Brinkman. *The Journal of Higher Education*, 68(6), 624-659.

Horn, L., & Peter, K. (2003). What colleges contribute: Institutional aid to full-time undergraduates attending 4-year colleges and universities. *Education Statistics Quarterly,* v. 5(2), Figure A.

Jackson, G. A., & Weathersby, G. B. (1975). Individual demand for higher education: A review and analysis of recent empirical studies. *The Journal of Higher Education,* v. 46(6), pp. 623-651.

Johnstone, B. D. (2004). The economics and politics of cost sharing in higher education: Comparative perspectives. *Economics of Education Review,* v. 23(4), pp. 403 – 410.

Kane, T. J. (1994). The causes and consequences of recent public tuition increases. Monograph, Kennedy School of Government: Cambridge, MA.

Kane, T. J. (1995). Rising public college tuition and college entry: How well do public subsidies promote access to college? *NBER Working Paper Series,* No. 5164.

Koshal, R. K., & Koshal, M. (2000). State appropriation and higher education tuition: What is the relationship? *Education Economics,* v. 8(1), pp. 81-89.

Leslie, L. L., & Brinkman, P. T. (1987). Student price response in higher education: The student demand studies. *The Journal of Higher Education,* v. 58(2), pp. 181-201.

Lewin, T. (2008, October 30). Downturn expected to drive tuition up. *New York Times,* p. A18.

Long, M. (2004). The impact of asset-tested college financial aid on household savings. *Journal of Public Economics,* v. 88(1-2), pp. 63-88.

Lowry, R. C. (2001a). Governmental structure, trustee selection, and public university prices and spending: Multiple means to similar ends. *American Journal of Political Science*, 45(4), 845-861.

Lowry, R. C. (2001b). The effects of state political interests and campus outputs on public university revenues. *Economics of Education Review,* 20(2), 105-119.

Marklein, M. B. (2002, August 8). Public universities raise tuition, fees – and ire. *USA Today,* p. 1A.

Monks, J. (2004). An empirical examination of the impact of college financial aid on family savings. *National Tax Journal*, v. 57(2), pp. 189-207.

Rouse, C. E. (1994). What to do after high school: The two-year versus four-year college enrollment decision. In R. G. Ehrenberg (Ed.), *Choices and consequences: Contemporary policy issues in education* (pp. 59-88). Ithaca, NY: ILR Press.

Rizzo, M., & Ehrenberg, R. G. (2003). Resident and nonresident tuition and enrollment at flagship state universities. *NBER Working Paper Series,* No. 9916.

St. John, E. P. (1990). Price response in enrollment decisions: An analysis of the high school and beyond sophomore cohort. *Research in Higher Education,* 31(2), 161-176.

Figure 1

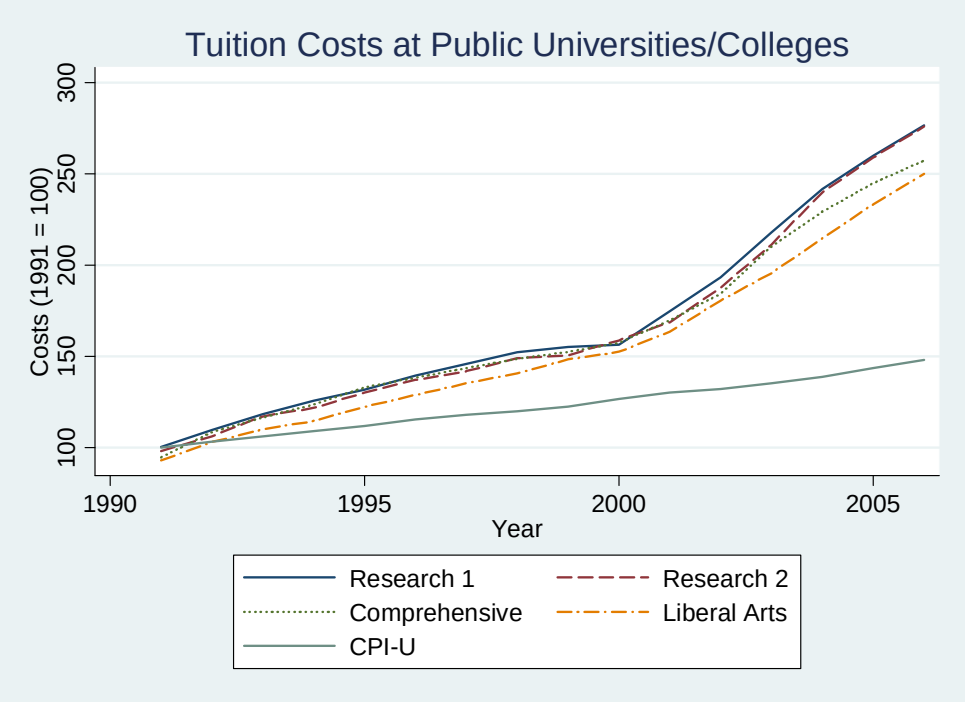
Tuition Costs at Public Universities/Colleges
Costs (1991 = 100)
100
150
200
250
300
1990
1995
2000
2005
Year
Research 1
Research 2
Comprehensive
Liberal Arts
CPI-U

Figure 2

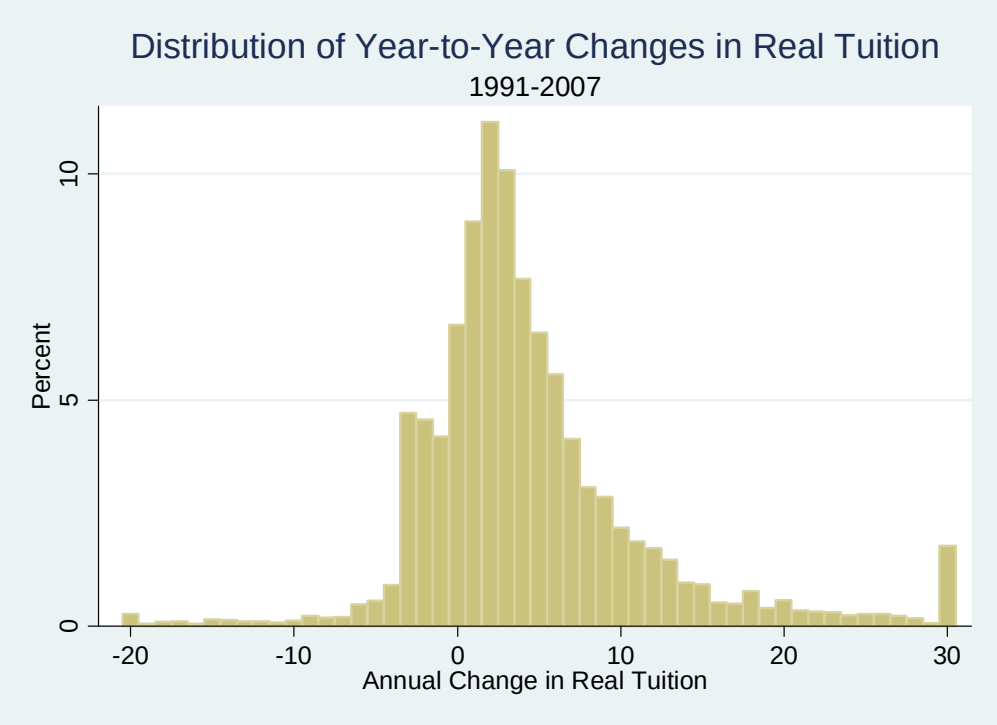
Distribution of Year-to-Year Changes in Real Tuition
1991-2007
Percent
0
5
10
-20
-10
0
10
20
30
Annual Change in Real Tuition

Figure 3

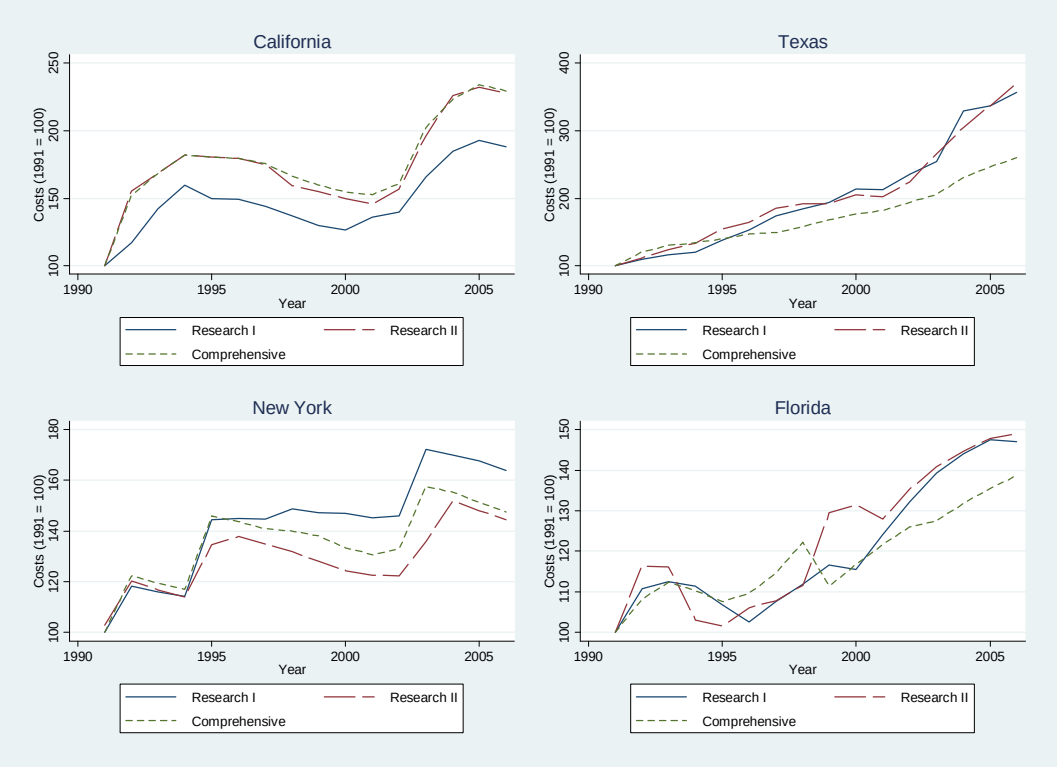
California
Texas
New York
Florida
Costs (1991 = 100)
Year
1990
1995
2000
2005
Research I
Research II
Comprehensive

Figure 4

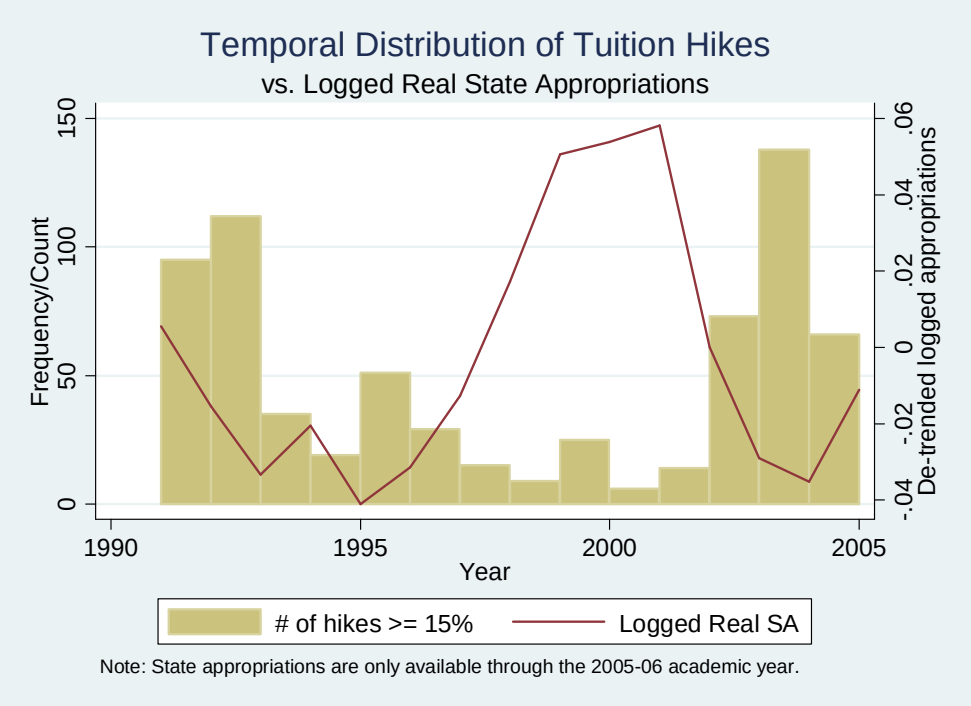
Temporal Distribution of Tuition Hikes
vs. Logged Real State Appropriations
Frequency/Count
0
50
100
150
De-trended logged appropriations
-.04
-.02
0
.02
.04
.06
1990
1995
2000
2005
Year
# of hikes >= 15%
Logged Real SA
Note: State appropriations are only available through the 2005-06 academic year.

Figure 5

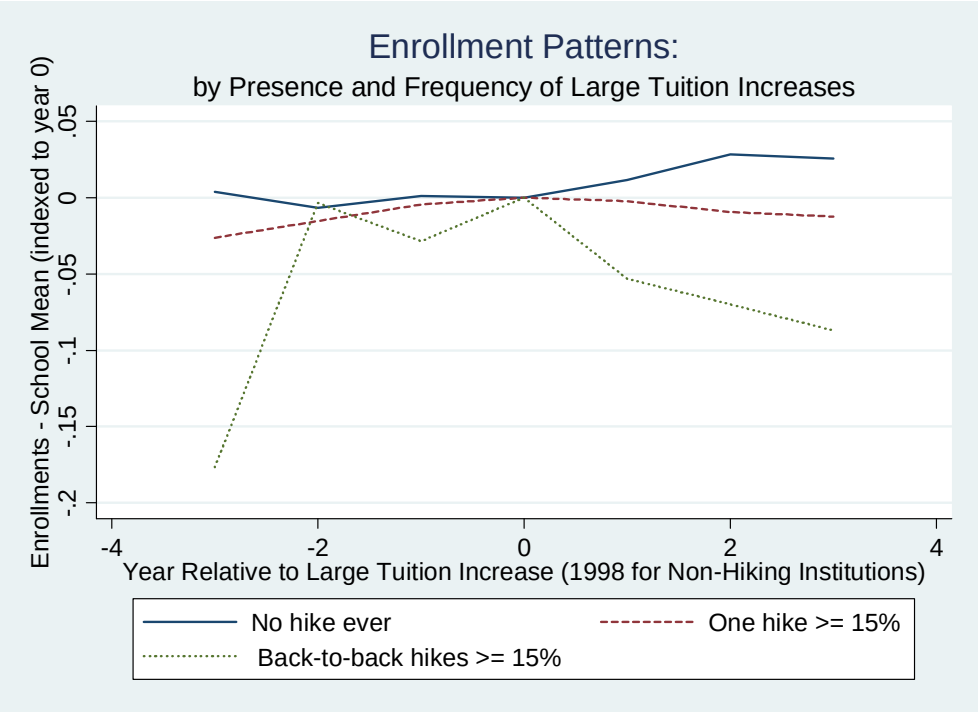
Enrollment Patterns:
by Presence and Frequency of Large Tuition Increases
Enrollments - School Mean (indexed to year 0)
-.2
-.15
-.1
-.05
0
.05
-4
-2
0
2
4
Year Relative to Large Tuition Increase (1998 for Non-Hiking Institutions)
No hike ever
One hike >= 15%
Back-to-back hikes >= 15%

Table 1 - Descriptive Statistics

Variable	N	Mean	Standard Deviation
Costs:			
In-state tuition and fees	7075	4209.69	1668.29
Average community college tuition and fees	7075	2036.19	852.14
Average 4-year private college tuition and fees	7075	16507.81	4241.29
Total scholarhips and fellowships (in $1,000)	7075	20500.00	25500.00
Total pell grants (in $1,000)	7075	6319.30	5222.99
Outcomes:			
12-month unduplicated headcount (enrollment)	7075	10714.98	8496.81
Log of 12-month headcount	7075	8.91	0.96
Total undergraduate credit hours	7075	261075.80	342050.20
Log of total undergraduate credit hours	7075	12.05	1.00
Total full-time first-time freshman enrollment	2965	1622.09	1398.12
Log of total full-time first-time freshman enrollment	2962	7.00	0.98
Other Controls:			
Average per capita income, by state	7075	32312.83	4888.09
Annual state unemployment rate	7075	5.13	1.25
State population	7075	9276186.00	8463302.00
Number of high school graduates, by state	7075	84642.65	79162.42

All monetary values are expressed in 2006 dollars.

Table 2 Enrollment Effects of Tuition Increases: Full Sample

Variable	Headcount	Credit Hours	FTFT
Log in-state tuition & fees	**-0.10721**	**-0.10529**	**-0.16364**
	(0.0312)***	(0.0349)***	(0.0580)***
Log avg. community college tuition & fees	**0.00385**	**0.04471**	**0.30279**
	(0.0318)	(0.0411)	(0.1305)**
Log avg. private 4-year tuition & fees	**-0.00422**	**-0.00555**	**-0.03505**
	(0.0284)	(0.0351)	(0.0466)
Log avg. per capita income	**0.36895**	**0.20635**	**0.07174**
	(0.1614)**	(0.1890)	(0.3206)
State population (per 10,000 people)	**0.00020**	**-0.00037**	**0.00022**
	(0.0001)	(0.0002)*	(0.0003)
Number of high school graduates (per 10,000 people)	**0.00770**	**0.03794**	**0.02129**
	(0.0059)	(0.0080)***	(0.0079)***
Unemployment rate	**0.01131**	**0.00907**	**0.00453**
	(0.0053)**	(0.0062)	(0.0080)
Log total scholarships and fellowships (dollars)	**0.05773**	**0.07147**	**0.08615**
	(0.0156)***	(0.0184)***	(0.0311)***
Log total Pell grants (dollars)	**0.22483**	**0.24081**	**0.25481**
	(0.0415)***	(0.0393)***	(0.0759)***
Observations	7075	7188	2962
R-squared	0.9825	0.9675	0.9860

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

All models also include institution and year effects.

Table 3 Enrollment Effects of Tuition Increases: By Insitutition Type

	Research I			*Research II*			*Comprehensive*			*Liberal Arts*		
Variable	**Headcount**	**Credit Hours**	**FTFT**	**Headcount**	**Credit Hours**	**FTFT**	**Headcount**	**Credit Hours**	**FTFT**	**Headcount**	**Credit Hours**	**FTFT**
Log in-state tuition & fees	**-0.24279**	**-0.17000**	**-0.15752**	**-0.16564**	**-0.20768**	**-0.04092**	**-0.06173**	**-0.00670**	**-0.07978**	**-0.03448**	**-0.03563**	**-0.15828**
	(0.0727)***	(0.0705)**	(0.0758)**	(0.0684)**	(0.1026)**	(0.1120)	(0.0584)	(0.0641)	(0.0884)	(0.0963)	(0.0978)	(0.1913)
Log avg. community college tuition	**0.07025**	**0.01038**	**0.14917**	**-0.02928**	**0.08006**	**0.45247**	**0.02529**	**0.07490**	**0.18089**	**-0.04039**	**0.07307**	**1.15391**
& fees	(0.0354)*	(0.0390)	(0.1223)	(0.0795)	(0.1172)	(0.4234)	(0.0447)	(0.0519)	(0.0999)*	(0.1068)	(0.0863)	(0.4859)**
Log avg. private 4-year tuition	**0.02956**	**0.01513**	**-0.02592**	**-0.05520**	**-0.02595**	**0.00039**	**0.03590**	**-0.02063**	**-0.07019**	**-0.08844**	**-0.10941**	**0.01380**
& fees	(0.0454)	(0.0548)	(0.0578)	(0.0590)	(0.0804)	(0.1105)	(0.0454)	(0.0586)	(0.0642)	(0.0842)	(0.0719)	(0.1589)
Log avg. per capita income	**-0.18136**	**0.01223**	**0.11975**	**0.64555**	**0.37389**	**1.24748**	**0.03446**	**-0.01970**	**-0.32565**	**1.26934**	**0.18097**	**-0.03580**
	(0.3419)	(0.3492)	(0.3210)	(0.3779)*	(0.4777)	(1.2491)	(0.2037)	(0.2885)	(0.2856)	(0.5862)**	(0.4445)	(0.8098)
State population	**0.00057**	**-0.00017**	**-0.00017**	**0.00070**	**0.00071**	**-0.00048**	**0.00024**	**-0.00039**	**0.00056**	**-0.00052**	**0.00001**	**-0.00099**
(per 10,000 people)	(0.0003)**	(0.0004)	(0.0003)	(0.0004)*	(0.0005)	(0.0006)	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0006)	(0.0010)
Number of high school graduates	**-0.00776**	**0.02271**	**0.01005**	**-0.02229**	**-0.02122**	**0.02198**	**0.00586**	**0.04227**	**0.02487**	**0.05177**	**0.03983**	**0.03603**
(per 10,000 people)	(0.0119)	(0.0173)	(0.0097)	(0.0154)	(0.0210)	(0.0159)	(0.0073)	(0.0105)***	(0.0104)**	(0.0291)*	(0.0249)	(0.0294)
Unemployment rate	**-0.00655**	**-0.01454**	**-0.01320**	**0.01237**	**0.01305**	**-0.01234**	**0.00612**	**0.00529**	**0.00225**	**0.03240**	**0.01452**	**0.00528**
	(0.0075)	(0.0103)	(0.0114)	(0.0161)	(0.0197)	(0.0168)	(0.0068)	(0.0077)	(0.0102)	(0.0157)**	(0.0131)	(0.0391)
Log total scholarships and	**0.01010**	**0.01151**	**0.07139**	**0.10613**	**0.09751**	**0.13427**	**0.03493**	**0.05283**	**0.07341**	**0.05061**	**0.09052**	**0.08833**
fellowships (dollars)	(0.0216)	(0.0251)	(0.0350)**	(0.0434)**	(0.0533)*	(0.0647)**	(0.0220)	(0.0259)**	(0.0416)*	(0.0494)	(0.0534)*	(0.0852)
Log total Pell grants (dollars)	**0.09764**	**0.09736**	**0.08958**	**0.14665**	**0.16853**	**0.35852**	**0.22521**	**0.24210**	**0.25545**	**0.41024**	**0.38654**	**0.36352**
	(0.0553)*	(0.0653)	(0.0678)	(0.0594)**	(0.0630)***	(0.2723)	(0.0644)***	(0.0614)***	(0.1224)**	(0.1261)***	(0.0959)***	(0.1910)*
Observations	1343	1358	576	832	848	358	3532	3582	1520	862	887	374
R-squared	0.8721	0.9063	0.9776	0.9693	0.9386	0.9732	0.9688	0.9387	0.9801	0.9518	0.9307	0.9539

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

All models also include institution and year effects.

Table 4 Enrollment Impacts of Tuition Increases: Top Public Schools vs. All Others

	Top 120			*All Others*		
Variable	**Headcount**	**Credit Hours**	**FTFT**	**Headcount**	**Credit Hours**	**FTFT**
Log in-state tuition & fees	**-0.23568**	**-0.27168**	**-0.12708**	**-0.08648**	**-0.08095**	**-0.15826**
	(0.0713)***	(0.0929)***	(0.0512)**	(0.0327)***	(0.0374)**	(0.0662)**
Log avg. community college tuition	**0.12437**	**0.02801**	**0.12298**	**0.00064**	**0.04603**	**0.29439**
& fees	(0.1071)	(0.1906)	(0.1661)	(0.0327)	(0.0421)	(0.1322)**
Log avg. private 4-year tuition	**0.02960**	**0.03087**	**-0.03182**	**-0.01060**	**-0.01292**	**-0.02359**
& fees	(0.0367)	(0.0609)	(0.0542)	(0.0314)	(0.0389)	(0.0527)
Log avg. per capita income	**-0.31273**	**0.48239**	**-0.59799**	**0.41007**	**0.15585**	**0.10958**
	(0.3939)	(0.4796)	(0.3991)	(0.1687)**	(0.1999)	(0.3428)
State population	**0.00062**	**-0.00003**	**-0.00035**	**0.00013**	**-0.00043**	**0.00027**
(per 10,000 people)	(0.0002)***	(0.0005)	(0.0003)	(0.0002)	(0.0002)**	(0.0003)
Number of high school graduates	**-0.00285**	**0.02279**	**0.02065**	**0.00916**	**0.04008**	**0.02435**
(per 10,000 people)	(0.0108)	(0.0200)	(0.0102)**	(0.0065)	(0.0087)***	(0.0090)***
Unemployment rate	**0.00183**	**0.00815**	**-0.00149**	**0.01197**	**0.00772**	**0.00510**
	(0.0098)	(0.0128)	(0.0107)	(0.0057)**	(0.0066)	(0.0088)
Log total scholarships and	**0.02090**	**0.05158**	**0.02981**	**0.06178**	**0.07324**	**0.09130**
fellowships (dollars)	(0.0233)	(0.0382)	(0.0268)	(0.0173)***	(0.0203)***	(0.0359)**
Log total Pell grants (dollars)	**0.05824**	**0.07401**	**0.04617**	**0.23559**	**0.25430**	**0.26441**
	(0.0754)	(0.0632)	(0.0727)	(0.0448)***	(0.0429)***	(0.0855)***
Observations	768	777	328	6307	6411	2634
R-squared	0.9090	0.9496	0.9883	0.9829	0.9613	0.9827

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

All models also include institution and year effects.

Table 5 Enrollment Effects of Large Tuition Hikes: Full Sample

	10 percent hike			*15 percent hike*		
Variable	**Headcount**	**Credit Hours**	**FTFT**	**Headcount**	**Credit Hours**	**FTFT**
Log in-state tuition & fees	**-0.10167**	**-0.07650**	**-0.12256**	**-0.09669**	**-0.07935**	**-0.11956**
	(0.0336)***	(0.0510)	(0.0731)*	(0.0342)***	(0.0496)	(0.0699)*
Log avg. community college tuition	**0.01756**	**0.05958**	**0.27356**	**0.01900**	**0.06050**	**0.27311**
& fees	(0.0326)	(0.0462)	(0.1320)**	(0.0326)	(0.0458)	(0.1311)**
Log avg. private 4-year tuition	**-0.01148**	**-0.02031**	**-0.03615**	**-0.00881**	**-0.01892**	**-0.03374**
& fees	(0.0283)	(0.0372)	(0.0455)	(0.0279)	(0.0365)	(0.0457)
Log avg. per capita income	**0.28612**	**0.23272**	**0.12927**	**0.29568**	**0.23504**	**0.13327**
	(0.1567)*	(0.1961)	(0.3207)	(0.1566)*	(0.1957)	(0.3251)
State population	**0.00032**	**-0.00024**	**0.00013**	**0.00031**	**-0.00026**	**0.00016**
(per 10,000 people)	(0.0002)**	(0.0002)	(0.0003)	(0.0002)*	(0.0002)	(0.0003)
Number of high school graduates	**0.00352**	**0.03350**	**0.02374**	**0.00415**	**0.03450**	**0.02270**
(per 10,000 people)	(0.0063)	(0.0080)***	(0.0080)***	(0.0064)	(0.0081)***	(0.0082)***
Unemployment rate	**0.01038**	**0.00906**	**0.00129**	**0.01094**	**0.00931**	**0.00137**
	(0.0055)*	(0.0062)	(0.0075)	(0.0055)**	(0.0062)	(0.0076)
Log total scholarships and	**0.04244**	**0.05845**	**0.07286**	**0.04220**	**0.05838**	**0.07299**
fellowships (dollars)	(0.0144)***	(0.0173)***	(0.0279)***	(0.0143)***	(0.0173)***	(0.0278)***
Log total Pell grants (dollars)	**0.20453**	**0.21339**	**0.26903**	**0.20367**	**0.21336**	**0.27094**
	(0.0431)***	(0.0410)***	(0.0811)***	(0.0430)***	(0.0410)***	(0.0814)***
Large hike dummy (year of hike)	**0.00902**	**0.01987**	**-0.00019**	**0.01364**	**0.03041**	**0.00139**
	(0.0064)	(0.0124)	(0.0089)	(0.0080)*	(0.0214)	(0.0119)
1st year after hike	**0.00357**	**-0.00109**	**-0.00473**	**-0.00193**	**-0.00328**	**-0.01791**
	(0.0062)	(0.0078)	(0.0086)	(0.0075)	(0.0109)	(0.0119)
2nd year after hike	**-0.00720**	**-0.01040**	**-0.00389**	**-0.01390**	**-0.00696**	**-0.00633**
	(0.0072)	(0.0081)	(0.0078)	(0.0104)	(0.0087)	(0.0124)
3rd year after hike	**-0.00089**	**-0.01073**	**-0.00495**	**-0.00537**	**-0.01756**	**0.00157**
	(0.0060)	(0.0079)	(0.0078)	(0.0069)	(0.0102)*	(0.0131)
Observations	6399	6509	2897	6399	6509	2897
R-squared	0.9831	0.9665	0.9872	0.9831	0.9665	0.9873

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

All models also include institution and year effects.