For Whom the Pell Tolls:
The Response of University Tuition to Federal Grants-in-Aid

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Abstract

The Pell grant program is the largest federal program for college students, with support to over three million students at more than six thousand institutions. A prominent question in public debate is whether Pell grants tend to be appropriated by universities through increases in tuition – consistent with what is known as the Bennett hypothesis. Based on a panel of 1554 colleges and universities from 1989 to 1996, we find little evidence of the Bennett hypothesis for in-state tuition for public universities. For private universities, though, increases in Pell grants appear to be matched nearly one for one by increases in list (and net) tuition. Results for out-of-state tuition for public universities are similar to those for private universities, suggesting that they behave more like private ones in setting out-of-state tuition. Institutional responses in these latter cases appear at odds with federal grants-in-aid policy.

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"If anything, increases in financial aid in recent years have enabled colleges

and universities blithely to raise their tuitions, confident that Federal loan subsidies would help cushion the increase."

– Former Secretary of Education, William J. Bennett (*NY Times, 1987)*

I. Introduction

Equal access to the pursuit of a college degree has been an important national goal for higher education in the United States since at least the early 1950s, but there is growing concern among both educators and policymakers that college is increasingly unaffordable for less well-to-do students. Average tuition has risen at rates far in excess of inflation over the last two decades, and federally subsidized, need-based aid has not kept pace with tuition, leaving needy students with an increasing gap to fill from other sources.

Rather than arguing for greater emphasis on need-based aid, however, some critics have argued instead that federally subsidized aid may be part of the problem, and have even proposed federal caps on tuition increases. Several former Secretaries of Education, beginning prominently with William Bennett, have expressed concern that increases in federal support, rather than lowering college expenses for students, are instead appropriated by universities through increases in tuition (*NY Times,* 1987, p. A31*; Chronicle of Higher Education*, 1998.) This view has come to be known as the Bennett hypothesis.

In this paper, we rely on a rich set of longitudinal data for a panel of 1554 universities between 1989 and 1996 to examine the Bennett hypothesis and related issues. The analysis focuses on federal Pell grants primarily because the Pell program is the largest federal grant program, funding more students than any other single program. In 1999-2000, for example, Pell expenditures were $7.3 billion, paid to over three million students at over six thousand participating institutions.[1] In addition, Pell grants do not require repayment, unlike other federal aid programs (e.g., the Ford Direct and Family Education Loan programs). Consequently, Pell

[1] For example, at the "very or most difficult" private universities in our data, based on the *Peterson's Guide* categorizations, the percentage of students receiving Pell is 16 percent, while the corresponding percentage at "very of most difficult" public universities is 22 percent. While we cannot distinguish Pell grants separately for in- and out-of-state students in our data, we know from auxiliary data from the Universities of Colorado, Indiana, and Oregon that the average percentages of in-state versus out-of-state students receiving Pell grants are 19 and 7 percent, respectively, for the late 1990 and early 2000 period.

grants ought to yield a larger tuition increase under the Bennett hypothesis because they increase student resources more directly than loans.

Based on these detailed data, we find little evidence that increases in federal Pell grants are positively linked to increases for in-state tuition at public universities, a finding consistent with other recent work (e.g, Rizzo and Ehrenberg, 2003). For private universities, though, we find that each increase in Pell aid is matched nearly one for one by tuition increases. Results for out-of-state tuition for public universities are similar to those for private universities, suggesting that they behave more like private universities in setting out-of-state tuition. One implication of these latter findings is that the objectives of federal grants-in-aid policy in higher education may in some cases be inconsistent with institutional responses. These conclusions contrast with some prior work, e.g., Connolly (1997), that finds consistency between federally funded academic research and institutional responses in support of academic research. Thus, our discussion considers why our approach may yield different conclusions to those found in prior work.

II. The Bennett Hypothesis

Even without turning to idiosyncratic organizational models of university behavior (as in Hoenack and Pierro, 1990; or Netz, 1999), one can offer three basic interpretations or explanations for the Bennett hypothesis. The simplest is provided by the standard competitive model. In this case, increases in student demand for enrollment arising from increases in financial aid are met with a relatively inelastic supply response from universities, so that increases in aid are translated into proportionately large increases in tuition. In the extreme case of perfectly inelastic supply, tuition increases by the full amount of the increased aid. This result would be counter to the intent of the Pell program, which seeks solely to increase enrollment through improved access to college. Pell grants could yield a pure enrollment effect in the case of perfectly elastic supply, in which case enrollments would increase but not tuition. With public universities, tuition may be regulated directly or indirectly by the state, possibly limiting tuition responses to enrollment pressures, at least for in-state students.

A second explanation relies on imperfect competition, possibly enabling universities to appropriate an even higher proportion of aid via tuition increases. In fact, universities are highly differentiated: public and private, exclusive and nonexclusive, liberal arts and comprehensive, large and small, close and far, and so on. In this case, the demand for enrollment at many universities is likely to be downward sloping, providing an opportunity for universities to exert market power in setting tuition and exaggerating increases in tuition beyond competitive levels. As in the competitive case, though, tuition increases at most by the full amount of the increased Pell aid. It is this explanation that appears to most closely match the rhetorical arguments of former Secretary Bennett and other critics. Indeed, there is evidence not only that presidents and provosts of public colleges and universities have a significant effect on enrollment supply (e.g., Coates and Humphries, 2002), but also that the total compensation of presidents of private colleges and universities is related to the level of tuition, even with expenditures, type of institution, reputation rankings, and other factors held constant (Tang et al, 2000).

A third explanation also relies on imperfect competition, but with price-discriminating behavior by universities. In this case, the Bennett hypothesis might hold if an increase in aid to needy students with relatively elastic demand induces an even greater increase in tuition for other students with relatively less elastic demand. With price discrimination, the price charged to each type of student is set, via discounts or internal scholarships, to equate marginal revenue in each case to the common marginal cost (where there are no cost differences).[2] In this case, the price increase for students with less elastic demand is *not* limited to the increased aid amount to needy students. With sufficiently steep marginal cost curves, relatively elastic demands by aid recipients, and relatively inelastic demands by other students, the increase in price for the market with relatively less elastic demand can *exceed* the increased aid amount.[3]

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[2]Netz (1999) finds evidence of this kind of price discriminating behavior for need-based aid and tuition for the schools that coordinate criteria for awarding need-based aid in the Ivy Overlap Group. Internally provided need-based aid substantially increases tuition for non-needy students, as well as for students who receive financial aid.

[3]Hill and Winston (2004), for example, using data for Williams College, find remarkably similar shares of income paid for a year of college for aided students across the five income quintiles. Specifically, the shares of pretax family incomes range from 6% to 20% - the lowest income quintile paying the smallest share and those at the 95th and 99th percentiles, paying full price, spending 22% and 9% of their family incomes, respectively. Thus, there is some evidence that the best private schools do

Previous tests of the Bennett hypothesis are suggestive. McPherson and Shapiro (1991), Turner (1997), and Li (1999) find evidence that tuition rises for at least some segments of the higher education market, but the segments where effects are significant and the magnitude of the effects vary substantially across the three studies. In part, we suspect, these inconsistencies may arise from unobserved heterogeneity among universities. Here, we deal with heterogeneity among universities using a relatively large pool of four-year universities and both fixed university effects and a richer set of control variables important to university enrollment and tuition policies.

Rizzo and Ehrenberg (2003) offer the most recent study of the effects of the Pell program on university tuition, both summarizing earlier work and examining the effects of various types of student aid on both in-state and out-of-state tuition for a panel of 91 public universities. They find no evidence that public universities increase tuition levels in response to increased federal or state financial aid for students. Our paper extends this question to a much larger sample of both public and private universities, primarily to explore possible differences in the tuition behavior of the public and private sectors in higher education. Our results confirm the negative findings of Rizzo and Ehrenberg for in-state tuition for public universities, but suggest that private university tuition increases by nearly one for one with increases in Pell aid.[4] Similarly, out-of-state tuition for public universities also tends to increase nearly one for one, which suggests that public universities may behave much more like private universities in setting out-of-state tuition.

III. Empirical Model

The Bennett hypothesis contends that universities raise tuition to appropriate increases in aid. As a point of departure, the empirical analysis examines whether aid has a direct tuition effect using a reduced-form panel approach. Our model specifies tuition of university *i* and time

price discriminate, typically via "need-blind" admissions policies.

[4]Li (1999) estimates the effects of Pell grants on both list and net tuition (i.e., tuition less institutional financial aid), with qualitatively similar results. Institutional financial aid data are not available for our full sample, but estimates for a sub-sample of 71 universities, discussed below, yield similar results for list and net tuition.

t (T_{it}) as depending broadly on external funding (F_{it}), a time trend (t), time-invariant university attributes (U_i), and Pell grants per recipient (P_{it}):

$$T_{it} = \alpha F_{it} + \beta t + \gamma (tU_i) + \delta P_{it} + \mu_i + \varepsilon_{it}$$

The coefficients α, β, γ, and δ represent parameter vectors for each category of explanatory variables. The university-specific fixed effect, μ_i, controls for unobserved university-specific differences in tuition, whereas ϵ_{it} is an idiosyncratic error term.[5] The time-invariant variables (U_i) enter only interactively with time, since their direct effects are subsumed by the fixed effect.

Tuition is measured by list tuition per student, denominated in thousands of dollars, though we also compare results for list and net tuition for a subsample of 71 universities for which data on institutional aid are available. Students who attend public institutions in their home state generally receive an implicit tuition subsidy reflecting state support provided directly to the university, but typically accompanied by controls over the tuition charged to in-state students. Thus, the model is estimated separately for in-state and out-of-state tuition for public universities. Strategic tuition responses to the provision of federal aid might be expected differ for in-state and out-of-state students, since the latter do not have direct political representation in the state and are easily distinguished from in-state students. Likewise, the model is estimated separately for public and private universities, because these institutions are likely to face different student demands that may generate a different tuition response to the provision of federal aid and because there are few if any political controls over the levels of private tuition.[6]

The explanatory variables include two controls for external sources of revenue. First, all public institutions and a few private institutions receive external support from the state, which is measured by the annual level of state appropriations per student as reported in the Higher Education General Information Survey. State subsidies of universities ease the budget constraint and are provided with the explicit or implicit expectation that tuition will be kept

[5]The fixed effects are collectively significant at the one percent level, and the alternative random effects are rejected at the one percent level.

[6]An F-test for whether public and private universities may be pooled, with a private dummy variable interacted with time, yields a value of 63.3, which rejects at the one percent level the hypothesis that the coefficients can be restricted to be the same for public and private universities.

"affordable" for in-state students. Thus, state appropriations should be negatively related to in-state tuition. However, in a reduced-form model state appropriations may also reflect a larger demand for higher-education, yielding a positive effect on tuition, if demand effects are not otherwise adequately controlled. In particular, greater state support of higher education may actually increase the demand and tuition of out-of-state students, who are likely to be attracted to well-funded universities that can provide higher quality faculty, smaller class sizes, or better equipped facilities.[7]

In addition, private universities and most public universities actively seek external support from outside donors. The empirical model measures the level of external support by the current value of endowment income per student. Tuition may be negatively related to endowment income if universities use donor funds to offset tuition or institutional costs. However, institutions with relatively large endowment income may also be relatively more attractive or costly to run, due to differences in quality or to restrictions of gifts to specific purposes.

The model includes a time trend to control for time varying factors such as changes in other prices and factors over time.[8] The time trend is interacted with several time-invariant university measures to account for differential tuition responses over time across institutional types. First, three time interactions are included for regional binary variables that equal one for universities located in the Northeast, South or West (the excluded region is the Midwest). The regional interaction terms yield region-specific time trends allowing tuition changes to vary by region over time, which could arise due to variations in cost factors, differential growth rates across regions in the college-age population and other demand-related factors, region-specific business cycles, or other region-specific influences.

Second, a time interaction is included with a binary variable measuring the most-selective institutions. Specifically, Upper20 equals one if an institution is at or above the

[7]Throughout, results for Pell grants are insensitive to whether state appropriations are included or excluded.

[8]Specifying time effects as individual year effects, rather than a time trend, yields similar results in the fixed-effects specifications for both public and private universities.

eightieth percentile within the state in any one of the following indices: the percent of incoming freshman with math SAT scores above 500, the percent of incoming freshman with verbal SAT scores above 500, or the percent of incoming freshman with ACT scores above 21. Thus, Upper20 indicates that the institution is in the upper quintile in student selectivity within the state. In addition, though, Upper20 equals one where the entrance requirements are reported as 'very difficult' or 'most difficult' in Peterson's 1989 Guide to Four-Year Colleges. The interaction of Upper20 with time permits tuition changes to differ over time for more selective institutions, which might arise if, for example, capacity constraints are more binding at more selective institutions.

For our key Pell variable, the model includes the average Pell aid per recipient.[9] The Bennett hypothesis suggests that the average Pell aid per recipient will have a direct positive relationship with tuition because universities respond by charging higher tuition. Furthermore, the coefficient is typically expected to be between zero and one, reflecting the extent to which federal aid support is passed on to the student in terms of higher tuition. However, the cost characteristics of the Pell program and the selection decisions of needy students could bias the coefficient on average Pell awards. Specifically, because the Pell grant formula uses cost of attendance to calculate a student's award, the tuition of a school may be positively correlated with the level of the Pell grant, which would yield an upward bias on the coefficient for Pell grants. The potential bias is limited, though, because the formula only depends in part on costs, of which tuition is only a part, and the allowable tuition has been subject to various maximum "caps" in the formula – all typically well below the relevant student costs. Hence, the vast majority of students receiving Pell grants are at maximum Pell award for a given year. Thus, one would expect any upward bias to be either negligible or modest. Alternatively, Pell grant recipients may be less likely to enroll in universities where tuition is rising more rapidly than average because they are relatively needy students, which would yield a negative bias to the coefficient for Pell grants.

[9]Due to data limitations, previous studies have typically used Pell aid per student, rather than per recipient. The latter is a better measure of the aid actually received on average, and does not necessarily vary with the number of students enrolled.

To examine potential endogeneity, we also estimate the fixed-effects model using instrumental variables. Specifically, the fixed-effects specification is estimated using both a set of binary variables that identify changes in the Pell program parameters and the lagged value of Pell grants to instrument for the current value of average Pell.[10] The binary variables for changes in parameters of the Pell program reflect exogenous government changes in the program in particular years: the "percent cost rule," which mandated the maximum percentage of tuition costs that could be covered by Pell grants, was raised from 60 to 100 percent in 1993; and budget shortfalls led the Office of Postsecondary Education to decrease the grants of all but the neediest students by a linear formula in 1990. Notably, the relevant Hausman tests indicate rejection of the null hypothesis of exogeneity for the average Pell grant at no less than the five percent level in each of the specifications presented.[11]

IV. The Data

The data used to estimate the empirical model are drawn from a unique nationwide panel of universities and colleges. The primary data source is the Computer-Aided Science Policy Analysis and Research Database System (CASPAR), which is a National Science Foundation (NSF) system for a wide range of statistical data on U.S. universities and colleges. This data library is based on a set of standardized institutional and discipline definitions across multiple sources in the database for the period between 1989 and 1998.[12] The data are derived from surveys of universities and colleges conducted by the NSF Division of Science Resource Studies and from surveys conducted by the National Center for Education Statistics (NCES)

[10]While most of our university data begin in 1989, the Pell data extend back to 1988, so we do not lose a year of panel data by including the lagged value of the Pell variable. Use of lagged Pell may introduce a potential bias in the fixed-effects IV specification, one that would declines with the number of years observed for each university. While this bias is likely modest with eight years of observations, we explore the sensitivity of our findings to the use of instrumental variables.

[11]The Hausman test is conducted by estimating the tuition regressions including both the actual and predicted Pell variables, with the latter from the instrumenting equation. The t-statistic on the predicted Pell variable equals 2.17, 4.08, and 4.47 for the public in-state, public out-of-state, and private tuition regressions, respectively, rejecting the exogeneity of average Pell aid at traditional levels in each case.

[12]IPEDs includes some data files for some institutions starting in 1982, but the financial files that include information on tuition and endowments includes largely missing data prior to 1989.

through its Higher Education General Information Survey (HEGIS) and the Integrated Post-secondary Education Data System (IPEDS).

These data are merged with institution-specific Pell data provided by the Department of Education that are available for the period between 1988 and 1996. The sample is restricted to the 10,283 institution-year observations for 475 four-year public universities and 1079 private universities that have at least six years of complete and contiguous data.[13] The analysis is restricted to 4-year universities, which are likely to have the best opportunity to exercise any market power in response to federal provision of Pell grants along the lines implied by the Bennett hypothesis.[14]

Descriptive statistics for public and private institutions in our sample are included in Table 1. The means show that, although the tuition at public institutions is approximately a quarter of that charged at private institutions, the average Pell award per recipient is approximately $1400 at both public and private institutions. This similarity likely occurs because the maximum Pell award, although increasing with tuition up to the cap, decreases with family income. This similarity in average Pell awards suggests that the average recipient at private universities either has a higher family income or is more likely to be at the Pell cap (or both), as compared to recipients who attend public universities. The descriptive statistics also indicate, as expected, that public universities depend significantly more on state support and significantly less on endowment income than private institutions and charge out-of-state tuition more than double that charged to in-state students. Overall, these differences suggest substantial differences for in- and out-of-state students, as well as for public and private universities, in how tuition might respond to changes in average Pell.

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[13]IPEDs includes data for 86,670 institution-year observations between 1982 and 1998 of which 28,880 of these observations are for four-year institutions. Dropping observations when Pell data are unavailable (before 1988 and after 1996) yields a sample of 14,763. Pell data are missing for 1,577 observations, reducing the sample to 13,205. Restricting the sample to institutions with at least six-years of complete and contiguous data reduces the sample to the 10,283 institution-year observations used in the empirical analysis. The mean attributes of the 4,490 institutions dropped in reducing the sample from 14,763 to 10,283 do not appear to differ in terms of tuition or other observable factors from those included in the sample.

[14]Auxiliary estimates (not presented here) for two-year institutions, with Upper20 equal to zero for all two-year schools, indicates no significant tuition response to average Pell aid.

IV. Empirical Results

A. In-State Tuition at Public Universities

Table 2 includes estimates of the in-state, public tuition model using ordinary least squares, fixed-effects, and fixed-effects IV estimators. The fixed-effects improve the explanatory power of the model, and the Hausman test rejects exogeneity of average Pell at the 5 percent level. Thus, the discussion will focus on the fixed-effects IV specification, which controls both for unobserved heterogeneity and the endogeneity of the Pell variable, and only uses the OLS and fixed effects specifications for comparison.

The coefficient on state appropriations indicates that public in-state tuition declines by $3 for each $1000 of state appropriations per student. At the margin, incremental state appropriations appear to only modestly depress in-state tuition, and perhaps support other state and university objectives, such as quality. Moreover, the coefficient on per-student endowment is insignificant in each of the specifications, suggesting that whatever the detailed effects of educational quality and student access, the net impact on in-state tuition is zero.

The time trend and its interactions are significant, indicating that tuition costs have increased over time. Specifically, the coefficient on the time variable indicates that tuition has increased by approximately $212 a year at lower-tier, 4-year public universities in the Midwest. Thus, given that the average in-state tuition bill is $2,934 per year, in-state tuition is predicted to be increasing at approximately 7 percent rate per year at public universities, conditioned on other factors that might determine the cost of attending college. However, the tuition cost increases appear to be $62 and $19 less per year at universities located in the South and the West, respectively, but $112 more for universities located in the Northeast. Moreover, Upper20 universities raised tuition an additional $82 a year. Thus, while the cost of college has been increasing across all universities, the absolute cost increases have been larger at higher quality institutions and at those located in the Northeast.

The coefficient on the average Pell award per recipient is positive and significant in the OLS specification, indicating that in-state public tuition rises by $359 per $1000 of Pell award. However, the fixed-effect specification reduces the coefficient to $130 per $1000 of Pell award,

which is significant only at the 10 percent level. The decline in the Pell award coefficient in the fixed-effects model suggests that in-state Pell students may tend to sort into relatively more costly public institutions within the state. If so, one implication is that the Pell award permits students to afford relatively more desirable (and more costly) universities.[15] Nonetheless, the IV estimates indicate no significant relationship between the average Pell award and tuition. Thus, the IV estimates do not support the Bennett hypothesis that public universities pass federal aid increases along to students via higher in-state tuition, possibly due to state oversight of resident tuition. Interestingly, the results for out-of-state tuition at public universities, to which we turn next, yield a starkly different conclusion.

B. Out-of-State Tuition at Public Universities

Results for out-of-state public tuition from OLS, fixed-effects and fixed-effects IV specifications are presented in Table 3. The coefficients on the explanatory variables across the three different models largely indicate the same qualitative conclusions. Again, though, the fixed-effect specification improves the explanatory power of the model, and the Hausman test rejects the exogeneity of the average Pell award at the 5 percent level. As before, the discussion of the results focuses on the fixed-effect IV results, with the OLS and fixed-effects specifications presented only for comparison.

Contrary to the results for in-state tuition, estimates for out-of-state public tuition indicate that increases in both state appropriations and endowment income both tend to increase out-of-state tuition. Specifically, a $1000 increase in state appropriations and endowment income per student yields, respectively, $5 and $139 increases in out-of-state tuition. This result likely arises becase, independent of university-specific fixed effects, the demand for institutions well supported both by the state and by outside donors is likely to be higher than for those with less

[15]Consistent with these findings, Curs, Singell, and Waddell (2005) using IPEDs and Pell data find evidence that increases in the generosity through the maximum Pell award allow students to switch from two-year to less-selective, four-year schools.

support. Presumably, institutional quality (and, possibly, extent of institutional financial aid) is valuable to prospective and current students.[16]

The time trend and its interactions indicate not only that out-of-state tuition has been increasing over time, but also that the increases vary across regions and institutional quality. Specifically, the coefficient on the time trend indicates an annual out-of-state tuition increase of $766, which implies an approximate 10 percent annual rate of increase over the $7828 average annual tuition. This 10 percent rate of tuition increase for out-of-state students is larger than the 7 percent increase for in-state tuition. Since the the fraction of students attending school out-of-state has tended to either increase or stay the same over this period, the higher rate of increase for out-of-state students suggests that they are paying an increasing fraction of tuition revenue at public universities.[17] The time interactions also indicate that out-of-state tuition has increased more for institutions located in the West and the Northeast (by $125 and $141, respectively), and less for institutions located in the South (by $143). Average annual out-of-state tuition has also increased by $366, roughly 50 percent more, at the selective institutions that rank in the "Upper 20" in their respective state.

The coefficient on the average Pell grant is significantly positive, indicating that out-of-state tuition rises by $804 per $1000, which implies an elasticity of about 0.4 beween changes in the average Pell grant and changes in out-of-state tuition. This effect is roughly twice that of the fixed-effects coefficient ($431), and the OLS coefficient is both insignificant and numerically close to zero. The effect of both fixed-effects and IV is to further increase the magnitude of the coefficient, indicating that the effects of unobserved heterogeneity and simultaneity yield downward biases on the Pell coefficient. This suggests that Pell recipients, who are on average

[16] A number of papers find that out-of-state demand responds to qualitative attributes of a university. Strathman (1994) finds an inverse relationship between state appropriations and student out migration. Siow (1997) presents evidence that schools with more successful researchers have a larger share of out-of-state and foreign students. Mak and Moncur (2003) find that states that offer a higher quality education and greater support for merit-based scholarships tend to retain a higher percentage of college-bound freshmen.

[17] The fraction of out-of-state students varies dramatically across states, but the percentage has stayed the same or increased for almost all universities over the period. For example, IPEDs data includes information on first-time in-state and out-of-state students for 1992 and 1996. The percentage of first-time, out-of-state students increased overall from roughly 9.1 to 9.6 percent at public universities between 1992 and 1996, and increased as well in each of the four regions, i.e., the West, South, Midwest, and Northeast.

relatively needier students, may be less likely to enroll at out-of-state institutions whose unobserved qualities contribute to higher than average tuition.

C. Tuition at Private Universities

Estimates of tuition equations are presented for private universities in Table 4, where again we focus primarily on the fixed-effects IV results. State appropriations, which are minimal for private universities, have no significant effect on tuition. Endowment income, though, has a significant effect on tuition, with a coefficient of $17 per thousand dollars of endowment income. Notably, this coefficient is larger than for in-state tuition for public universities, where the coefficient is insignificant, but smaller than for out-of-state tuition for public universities, where the coefficient is $139 per thousand dollars of endowment income. In part, at least, this pattern likely arises from the much larger base of endowment income for private universities, as well as perhaps a larger incremental effect for endowment income on quality in attracting out-of-state students to public universities.

The time and regional interactions indicate that tuition has risen by $766 per year for private universities in the Midwest, or about 6% a year relative to the average tuition of $12,007 over the period. Tuition rose less rapidly in the South (by $143 per year), and more rapidly in the West and Northeast (by $125 and $141, respectively). Also, tuition at the selective private universities ranked in the Upper20 rose by an additional increment of $366 per year. As compared to public universities, the effect of Upper20 is roughly double the effect for out-of-state tuition and four times the effect for in-state tuition – both roughly proportionate to the relative levels of average tuition.

The coefficient on the average Pell grant per student indicates that tuition rises significantly by $863 per $1000, nearly one-for-one with the average Pell grant. This estimate implies an elasticity of about 0.3 between changes in the average Pell grant and changes in private tuition. The OLS estimate in the first column of Table 4, though, is significantly negative (-$1451 per $1000), and the fixed-effects estimate in the middle column ($740) rises nearly to that of the fixed-effects IV estimate. Hence, the estimated effect does not appear quantitatively sensitive to instrumentation, even though the Hausman test again rejects exogeneity at the 5

percent level. The fixed-effect results suggest that lower-income students, with larger Pell awards, are drawn systematically to private schools with lower tuition, whereas we found that Pell aid tended to draw those students toward more expensive public schools within the state.

D. Discussion of Empirical Results

Taken as a whole, our results indicate that there is little or no effect of Pell grants on in-state tuition for public universities, at least in the fixed-effects or fixed-effects IV specifications. This negative result coincides with that of Rizzo-Ehrenberg. For out-of-state tuition, though, there is a significant response to Pell grants, indicating that tuition rises by $431 (per $1000 in average Pell aid) in the fixed-effects results or $863 in the fixed-effects IV results. Note that the IV estimate is roughly double that of the fixed-effects estimate. However, even if one takes the more conservative fixed-effect estimate, which controls for time-invariant unobserved heterogeneity, out-of-state tuition still rises by a ratio of just under 1 to 2 with changes in average Pell aid, rather than the nearly one-for-one rise implied by the IV estimate. The greater impact of Pell grants on out-of-state versus in-state tuition is likely a reflection of greater direct control by states over the level and growth of in-state tuition.

Our positive finding for out-of-state tuition, while consistent with our results for tuition at private universities, contrasts with Rizzo-Ehrenberg, who do not find a significant effect for Pell grants on out-of-state tuition at public universities. The difference could arise for several reasons. The samples of universities differ not only in size (475 public universities versus 91), but also in composition. Our data are for a wider range of both national and regional universities, but are also for a shorter and on average more recent time period (1989-1996 versus 1979-1998). In addition, we use the average Pell award per recipient as our Pell variable, while Rizzo-Ehrenberg use the *maximum* Pell award a student would be eligible for at each university. Our use of actual awards is driven by the argument that it is the actual award students receive, rather than only the maximum award, that is most relevant to their enrollment and the potential effects on university tuition. Indeed, if instead we use a smaller sample of national universities, more akin to the Rizzo-Ehrenberg sample, or the maximum Pell award, we

find an effect on out-of-state tuition virtually identical to that in our full sample, but signficant only at the ten percent level.[18]

The positive findings for the Bennett hypothesis for out-of-state public and private tuition are subject to multiple interpretations. The most straightforward one is that increases in Pell aid lead directly to hikes in average tuition actually charged to students, i.e., tuition net of institutional aid. An alternative, but less straightforward explanation is that increases in Pell aid lead to hikes in list tuition, but not necessarily in average tuition charged, because the higher tuition charged to some students is used to expand support for needier students receiving Pell grants. If so, one might expect that the relative access of needier Pell students would have increased over the period.

We do not have information on institutional aid for the large set of universities in our sample, but we do know that the proportion of students receiving Pell aid expanded only slightly over the period, from 29 to 30% and 28 to 30%, respectively, for public and private universities in our sample. Hence, hikes in out-of-state public or private tuition in response to increases in Pell aid do not appear to have contributed to any substantial expansion of enrollment for Pell recipients via enhanced institutional aid to those students. This conclusion is reinforced for a sub-sample of 71 public and private universities for which we do have data on institutional aid, where we find little difference between list and net tuition in the effects of Pell grants.

Given the magnitude of our findings for private and public out-of-state tuition, where Pell aid and tuition appear to move nearly one for one, our results appear most consistent with the third hypothetical model, i.e., imperfect competition with price discriminating behavior, since this model does not constrain the effect to be bounded from above by one. Consistent with Netz (1999), private universities appear to raise tuition for both non-needy and needy students in response to increases in aid to needy students, possibly with a modest net decline in tuition for needy students. Similarly, public universities appear to raise tuition for both non-needy and needy out-of-state students, but with a net decline in tuition for needy out-of-state students. Of

[18]Our subsample consists of 79 of the 91 universities in Rizzo-Ehrenberg that could be identified in our data.

course, whether or not the increased university revenues is welfare improving, e.g., by augmenting quality of instruction or socially beneficial research, is a separate question.

V. Concluding Remarks

A prominent question in public debate for nearly two decades is whether Pell grants tend to be appropriated by universities through increases in tuition – consistent with what is known as the Bennett hypothesis. Based on a panel of 1554 colleges and universities from 1988 to 1996, we find little evidence of the Bennett hypothesis for in-state tuition for public universities. For private universities, though, increases in Pell grants appear to be matched nearly one for one by increases in tuition. Results for out-of-state tuition for public universities are similar to those for private universities, suggesting that they behave more like private universities in setting out-of-state tuition. Notably, we also find that both higher state appropriations and endowment incomes permit public universities to charge higher out-of-state tuition, presumably because the larger pool of resources makes the university stronger and more attractive to students. Overall, then, there is evidence both for and against the Bennett hypothesis. Specifically, the evidence for in-state tuition charged by public universities tends to reject any substantial or significant effect; alternatively, the evidence for out-of-state public and private tuition tends to support the Bennett hypothesis.

Collectively, the results suggest that the pricing behavior of higher education institutions is sensitive to both political and market interests, as well as, perhaps, to individual institutional objectives with regard to access for needy students. The fact that out-of-state tuition appears to respond to the level of the average Pell grant, while in-state tuition does not, suggests that public universities are either explicitly or implicitly constrained to maintain low-cost access for in-state students, but not necessarily out-of-state students. Differences for in-state and out-of-state students in the observed tuition responses to changes in the average Pell award suggests that intra-state political factors are particularly strong – especially since prior evidence on demand elasticities indicate that demand, if anything, is less elastic for in-state than out-of-state students (e.g., Leslie and Brinkman, 1988; Curs and Singell, 2002).

Increases in Pell awards and eligibility did not lead to substantially greater access for relatively needy Pell recipients, and we find similar effects of Pell awards on list and net tuition (i.e., tuition less institutional aid), at least for our subsample of 71 universities for which data are available. These findings are most consistent with a model of imperfect competition with price discriminating behavior, implying that private universities raise tuition (and public universities raise out-of-state tuition) on both needy and non-needy students, possibly with a modest net decline in tuition for needy students. Even so, future work investigating the robustness of these findings to net versus list tuition would be particularly useful. Understanding how tuition responds to the provision of public support is critical to evaluating whether and how the current movement away from state support of higher education will affect access of needy students to a college education.

References

Connolly, L.S. (1997). "Does External Funding of Academic Research Crowd Out Institutional Support?" *Journal of Public Economics*, 64:3, 389-406.

Coates, D & Humphreys, B.R. (2002) "The Supply of University Enrollments: University Administrators as Utility Maximizing Bureaucrats, *Public Choice*." 110, 365-92.

Curs, B. & Singell, L.D. Jr. (2002) "An Analysis of the Application Process and Enrollment Demand for Instate and Out-of-State Students at a Large Public University." *Economics of Education Review*, 21, 111-24.

Curs, B, Singell, L.D., Jr., & Waddell, G. (2005) "Money for Nothing? The institutional Impact of Changes in Federall Financial Aid Policy." University of Oregon Working Paper.

Hill, C. & Winston, G. (2004) "Access: Net Prices, Affordability, and Equity At A Highly Selective College, forthcoming, *Economics of Education Review*.

Hoenack, S.A. & Pierro, D.J. (1990). "An Econometric Model of a Public University's Income and Enrollment." *Journal of Economic Behavior and Organization*, 14, 403-423.

Leslie, L. and Brinkman P. (1988). *The Economic Value of Higher Education*. New York: Macmillian.

Li, J. (1999). "Estimating the Effects of Federal Financial Aid on College Tuition; A Study of Pell Grants," Harvard University Dissertation.

McPherson, M.S. & Schapiro, M.O. (1991). "Does Student Aid Affect College Enrollment? New Evidence on a Persistent Controversy." *American Economic Review*, 81, 309-18.

Mak, J & Moncur, J.E.T. (2003) "Interstate Migration of College Freshman." *Annals of Regional Science*, 37, 603-12.

Netz, J. S. (1999). "Non-Profits and Price-Fixing: The Case of the Ivy League." Purdue University Working Paper.

Rizzo, M.J. & Ehrenberg, R.G. (2003). "Resident and Nonresident Tuition and Enrollment at Flagship State Universities." National Bureau of Economic Research, Cambridge, MA, Working Paper 9516.

Siow, A. (1997) "Some Evidence on the Signalling Role of Research in Academia." *Economic Letters*, 54, 271-76.

Strathman, J.G. (1994) "Migration, Benefit Spillovers, and State Support of Higher Education." Urban Studies, 31, 913-20.

Tang, T.L.P, Tang, D.S.H, & Tang, C.S.Y. (2000). "Factors Related to University Presidents' Pay: An Examination of Private Colleges and Universities." *Higher Education*, 39, 393-415.

Turner, S. (1997). "Essays on the Economics of Higher Education." University of Michigan Dissertation.

Table 1 Descriptive Statistics for Public and Private Universities[a]

	All Institutions	Public Universities	Private Universities
In-state Tuition	8.788	2.934	12.007
	(6.066)	(1.221)	(5.198)
Out-of-State Tuition	10.535	7.828	12.023
	(4.958)	(3.004)	(5.186)
State Appropriations	4.712	13.061	0.121
	(24.179)	(39.226)	(0.878)
Endowment Income	1.135	0.222	1.637
	(3.950)	(3.950)	(4.692)
Time	11.263	11.530	11.116
	(2.112)	(2.283)	(2.000)
South	0.342	0.413	0.304
	(0.475)	(0.492)	(0.460)
West	0.130	0.167	0.109
	(0.336)	(0.373)	(0.312)
Northeast	0.229	0.142	0.277
	(0.420)	(0.349)	(0.448)
Upper20	0.210	0.157	0.240
	(0.408)	(0.364)	(0.427)
Average Pell	1.406	1.398	1.410
	(0.163)	(0.150)	(0.170)
Number of Observations	10283	3648	6635

Standard errors in parentheses

a - State appropriations, endowment income, and average Pell are in units of $1000 per student (or recipient, in the case of average Pell). The time trend is set as 1983 = 1 and ranges from 8 to 15 for the years 1989 to 1996.

Table 2 Regressions for In-State Tuition at Public Universities

	OLS	Fixed Effects	Fixed Effects-IV
State Appropriations	-0.001	-0.003	-0.003
	(0.001)	(0.001)***	(0.001)***
Endowment Income	-0.005	0.015	0.015
	(0.009)	(0.011)	(0.011)
Time	0.232	0.211	0.212
	(0.008)***	(0.005)***	(0.006)***
Time*South	-0.071	-0.062	-0.062
	(0.003)***	(0.005)***	(0.005)***
Time*West	-0.051	0.020	0.019
	(0.004)***	(0.006)***	(0.006)***
Time*Northeast	0.104	0.112	0.112
	(0.004)***	(0.007)***	(0.007)***
Time* Upper20	0.079	0.082	0.082
	(0.003)***	(0.006)***	(0.006)***
Average Pell	0.359	0.130	0.160
	(0.116)***	(0.070)*	(0.116)
Constant	-0.119	0.273	0.219
	(0.225)	(0.130)**	(0.214)
Observations	3648	3648	3648
R-squared	0.53	0.79	-

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3 Regressions for Out-of-State Tuition at Public Universities

	OLS	Fixed Effects	Fixed Effects-IV
State Appropriations	0.003	0.005	0.005
	(0.001)***	(0.001)***	(0.001)***
Endowment Income	0.061	0.140	0.139
	(0.024)**	(0.028)***	(0.028)***
Time	0.580	0.589	0.605
	(0.021)***	(0.013)***	(0.017)***
Time*South	-0.096	-0.086	-0.091
	(0.008)***	(0.013)***	(0.013)***
Time*West	0.119	0.151	0.147
	(0.010)***	(0.016)***	(0.016)***
Time*Northeast	0.143	0.185	0.184
	(0.010)***	(0.017)***	(0.017)***
Time* Upper20	0.239	0.168	0.171
	(0.008)***	(0.014)***	(0.015)***
Average Pell	0.073	0.431	0.804
	(0.302)	(0.183)**	(0.302)***
Constant	0.542	-0.148	-0.830
	(0.584)	(0.340)	(0.556)
Observations	3648	3648	3648
R-squared	0.47	0.82	-

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4 Regressions for Tuition at Private Universities

	OLS	Fixed Effects	Fixed Effects-IV
State Appropriations	0.181	-0.015	-0.015
	(0.055)***	(0.021)	(0.021)
Endowment Income	0.043	0.017	0.017
	(0.011)***	(0.006)***	(0.006)***
Time	0.508	0.760	0.766
	(0.028)***	(0.010)***	(0.017)***
Time*South	-0.188	-0.142	-0.143
	(0.010)***	(0.012)***	(0.012)***
Time*West	0.121	0.124	0.125
	(0.014)***	(0.016)***	(0.016)***
Time*Northeast	0.273	0.142	0.141
	(0.011)***	(0.012)***	(0.012)***
Time* Upper20	0.525	0.368	0.366
	(0.010)***	(0.011)***	(0.011)***
Average Pell	-1.451	0.740	0.863
	(0.325)***	(0.117)***	(0.285)***
Constant	6.577	1.416	1.180
	(0.673)***	(0.231)***	(0.551)**
Observations	6635	6635	6635
R-squared	0.49	0.87	-

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%