

For Whom the Pell Tolls: Market Power, Tuition Discrimination, and the Bennett Hypothesis

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Abstract

Are federal Pell grants “appropriated” by universities through increases in tuition – consistent with what is known as the Bennett hypothesis? Based on a panel of 71 universities from 1983 to 1996, we find little evidence of the Bennett hypothesis among either public or lower-ranked private universities. For top-ranked private universities, though, increases in Pell grants appear to be *more* than matched by increases in net tuition. The behavior most consistent with this result is price discrimination that is not purely redistributive from wealthier to needier students.

“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 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 the rate 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 ((McPherson and Shapiro, 1991; Duffy and Goldberg, 1998).

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. Several former Secretaries of Education, beginning prominently with William Bennett, have expressed concern that increases in federal support do not lower college expenses for students, but are 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 universities between 1983 and 1996 to examine the Bennett hypothesis and related issues. The analysis focuses on federal Pell grants for several reasons. First, the Pell program is the largest federal grant program, funding the most students at the most schools. In 1999-2000, for example, Pell expenditures were \$7.3 billion, paid to over three million students at over six thousand participating institutions. Second, Pell grants do not require repayment, unlike other federal aid programs (e.g., the Ford Direct and Family Education Loan programs). Consequently, Pell grants ought to yield a larger tuition increase under the Bennett hypothesis because they

increase student resources more directly than loans. Lastly, the Pell program began in 1972, before many of the other federal programs, and has changed the per-student allocation several times during the period. Thus, it offers relatively long and varied data.

Based on these detailed data, we find little evidence that increases in federal Pell grants are positively linked to increases in net tuition at public or lower-ranked private universities. For top-ranked private universities, though, we find that each increase in aid is *more* than matched by net tuition increases, so that tuition net of other student aid rises by even more than the increase in Pell aid. We explore several explanations for this finding, with a prominent role for market power and tuition discrimination that is not purely redistributive.

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 at least three interpretations or explanations for the Bennett hypothesis. The simplest is provided by the standard competitive model. In this simple 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 average net tuition. One might expect the supply of the “best” universities to be less elastic than the supply of other universities, and consequently greater tuition increases for these universities even with perfect competition. In the extreme case of perfectly inelastic supply, tuition increases by the full amount of the increased student aid. This result would be counter to the original intent of the Pell program, which sought 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 net tuition.

A second explanation relies on imperfect competition, enabling universities to extract 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 net tuition and exaggerating increases in tuition beyond competitive levels. Indeed, this explanation appears to most closely match the rhetorical arguments of former Secretary Bennett and other critics. Again, one might expect greater net tuition increases for elite, exclusive universities, since they have greater market power. Even in this case, though, net tuition increases at most by the full amount of the increased Pell aid.

A third explanation also relies on imperfect competition, but with price-discriminating behavior by universities. In this case, an increase in aid to needy students with relatively elastic demand might induce not only an increase in tuition for these students, but also 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 scholarships, to equate marginal revenue in each case to the common marginal cost (if there are no cost differences).¹ 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 average net tuition can *exceed* the increased aid amount.

Because this explanation is more complex than the simple version of the Bennett hypothesis, we explore alternative interpretations of price discriminating behavior. For example, higher increases in tuition for some students may or may not result in lower net tuition for other (less well-to-do) students by implicitly funding internal scholarships or other forms of tuition discounts. However, when evidence of price discrimination is unambiguous (i.e., when

¹Note that, here, “price” refers to tuition less university tuition discounts or scholarships.

increases in Pell grants are matched more than one-for-one by increases in net tuition), we also know that price discrimination is not purely redistributive.

Previous studies with evidence pertinent to the Bennett hypothesis are suggestive. McPherson and Shapiro (1991), Turner (1997), Li (1999), Netz (1999), Acosta (2001), and Long (2002) all find evidence that tuition rises for at least some segments of the higher education market, but the extent and type of aid considered, the segments where effects are significant, and the magnitude of the effects vary substantially across the studies. Most recently, Rizzo and Ehrenberg (2003) examine the effects of various types of student aid on both in-state and out-of-state tuition for a panel of 91 public universities, and find no evidence that public universities increase tuition levels in response to increased federal or state financial aid for students. We suspect these inconsistencies arise, at least in part, from several factors, including differences between public and private universities, variations in market power, and unobserved heterogeneity among universities. Here, we distinguish between public and private universities, explore the role of market power, and also control for unobserved heterogeneity using both fixed effects in the panel data and a richer set of control variables. All of these distinctions appear critical in our results.

Other studies of financial aid have focused primarily on demand-side effects. Leslie and Brinkman (1987) survey numerous enrollment studies that use both aggregate time-series and individual-level data for enrollment and the net tuition price (i.e., tuition minus financial aid) and find that enrollment demand is inelastic. More recent work relies on individual variation in college financial aid. Angrist (1994), for example, uses survey responses of military veterans to the veterans benefit program for college; Kane (1994) panel data for 18-19 year-old black youths drawn from the Current Population Survey; and Dynarski (1999) individual data from the Social Security Benefit Program. Collectively, these studies indicate a small, positive enrollment response to financial aid.

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. In our baseline model, we specify average net tuition of university i and time t (T_{it}) as depending broadly on external funding (F_{it}), a time trend (t), time-invariant and time-varying university attributes (U_i and V_{it} , respectively), market power (M_i), and Pell grants per recipient (P_{it}):²

$$T_{it} = \alpha F_{it} + \beta t + \gamma(tU_i + V_{it}) + \delta t M_i + \phi P_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

The coefficients α , β , γ , δ , and ϕ 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. The time-invariant variables (U_i and M_i) enter only interactively with time.

Market power is assumed to be time invariant because the data used in the empirical analysis are comprised of a relatively short panel in which the market position of a particular university is unlikely to change substantially relative to its competitors. Although the market power of a given university may not change over the time interval considered, the greater competition among public and private universities documented in recent work suggests that market position may have become relatively more important (McPherson, 1998). Thus, the effects of market power (and other observed but time-invariant university attributes) are allowed to vary over time, whereas the effects of unobserved or unmeasured time-invariant attributes of a university are measured by the fixed effect, μ_i .

²Other studies have used Pell aid per *student* but this measure may tend to exaggerate the corresponding coefficient because it is confounded by the proportion of students who are Pell recipients.

As an alternative to the baseline model expressed by equation (1), we account for the potential role of market power in condition responses to the provision of Pell grants by introducing an interaction between Pell grants and a measure of market power in equation (2):

(2)

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

The coefficient on the interaction between P_{it}

and M_i , λ , measures the difference in the response of net tuition to changes in Pell grants by universities with differential market power. The expectation is that universities with greater market power will raise tuition more in response to increases in Pell grants.

IV. The Panel Data

The panel data used in the analysis 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) based system that provides access to a wide range of statistical data focusing 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 1983 and 1996. 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) through its Higher Education General Information Survey (HEGIS) and the Integrated Post-secondary Education Data System (IPEDS).

To focus on universities likely to have the best opportunity to exercise any market power in response to federal provision of Pell grants, we limit the analysis to the 71 public and private universities found in both CASPAR and the *U.S. News and World Report* ranking of top higher-education institutions in the United States and for which all relevant data are available for a

minimum of three years.³ These data include the Fall tuition between 1983 and 1996 in addition to information on the total dollar value of university endowments and Pell grants. The panel is unbalanced because complete data for individual universities are available for an average of 11 of the 14 years in CASPAR. We supplement these data with information on the yearly state appropriations to each university, the annual average SAT scores in the state.

Tuition and other revenues

Average net tuition is measured by list tuition per student, denominated in thousands of dollars, minus tuition discounts and financial aid, excluding Pell grants.⁴ For public universities, tuition also differs between in-state and out-of-state students. Most students at public universities attend college in their home state, and the analysis focuses on in-state tuition for public universities – though we also discuss results for out-of-state tuition.

The explanatory variables include two controls for external sources of revenue. First, all public institutions and some private institutions receive external support from the state, which is measured by the annual level of state appropriations per student from 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 “affordable” (at least for in-state students). Thus, state appropriations should be negatively related to net 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.

³The requirement of complete data for a minimum of three years results in dropping 23 universities. These have an average academic rank of 89 versus 60 for the 71 universities with complete data.

⁴We use net tuition to avoid problems posed by including elements of the financial aid package on both sides of the regression, since components of the aid package are jointly determined (Singell, 2001; Rizzo and Ehrenberg, 2003).

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

Time trends and university attributes

The model includes a time trend (1983=83) to control for time varying factors such as changes in the price level and other factors over time.⁵ The time trend is interacted with several time-invariant variables to account for a variety of factors: three regional controls that equal one if the university is located in the Northeast, South or West (the excluded region is the Midwest); and whether the university is private (the excluded category is public institutions). These interaction terms permit region-specific time trends, as well as trends specific to public or private institutions. Net tuition changes may vary by region over time because of 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. Again, these time-invariant controls can only be included as interaction variables in the fixed-effects specification. In addition, we include one time-varying attribute, the annual average of cumulative SAT scores in the state. These are used to control for heterogeneity across states in the quality of potential students, the relative demand for higher education in the state, and other factors correlated with SAT scores.

Market power

⁵Specifying the time effects as individual year effects, rather than a time trend, yields similar results in the fixed-effects results for both the pooled and separate samples for public and private universities.

The market power of a university is likely to be related to its overall public reputation. As a measure of reputation, we use the *U.S. News and World Report* rankings of colleges and universities in 1994. The 1994 ranking is used because it is the first comprehensive ranking of U.S. colleges and universities, and because subsequent changes within our sample period are minor. For a number of reasons, we group universities into two broad categories for premier universities ranked in the top 100 and the group of universities ranked outside the top 100. These groupings help to reduce errors in our measure of reputation and also aid in permitting potential nonlinearities in the effect of market power. The (time-invariant) rank variable is interacted with the time trend, which permits variation in tuition growth between qualitatively different universities.

Pell grants

Again, the Bennett hypothesis suggests that the level of federal financial aid per recipient will have a direct positive relationship with net tuition because universities respond by charging higher tuition (or lowering institutional aid). As a consequence, we include the average Pell grant per recipient in the model. To examine whether the response varies with the degree of market power, we also estimate specifications (from equation 2) that include an interaction of Pell grants with the binary rank variable. We enter both interactions separately (i.e., interactions for those in the top 100 and those outside the top 100), so that the two Pell coefficients are separately estimated. The coefficients on the interaction terms are expected to increase for higher ranked universities (e.g., a larger effect for universities in the top 100).

Descriptive statistics

Table 1 provides descriptive statistics for the 880 observations drawn from the 71 universities between 1983 and 1996. Of the 71 universities, 33 are public and 38 private. The data show that average net tuition at private institutions is almost six times as high as at public institutions. As expected, public universities receive more state support, and private universities have larger endowments. Despite higher net tuition at private universities, Pell recipients in private and public universities receive roughly the same amount of Pell support, which may indicate that most recipients are at the maximum “cap” on the amount of Pell aid. In addition, private universities are disproportionately represented in the top 100 group of universities .

V. Empirical Results

OLS and fixed-effects regressions

Table 2 presents estimates for both equations (1) and (2), i.e., with and without interactions between the average Pell grant and variables measuring the qualitative rank of the university. Results are presented for both ordinary-least-squares and fixed-effects estimators. Most of the coefficients are significant at traditional levels. However, the magnitudes and, in some cases, the signs of the coefficients differ between the OLS and fixed-effects estimates. Thus, the results suggest that the unobserved heterogeneity among universities is both an important factor in explaining tuition and correlated with the observed attributes. For brevity, the discussion below focuses primarily on the fixed-effects estimates, with OLS estimates used for comparison.

The coefficients on per-student state appropriations and endowments are negative and significant in the fixed-effects (FE) regression. A thousand dollar increase in state appropriations (total endowment) per student is associated with a decrease in net tuition of about \$100 (\$11). Thus, the results suggest that greater external support by government and private donors is associated with a modest net reduction in tuition. As an example of the role of

heterogeneity, the coefficient on state SAT scores is negative and significant in the OLS regressions, yet positive and significant for the FE regressions. This turnaround suggests that unobserved factors associated with higher state SAT scores are also associated with lower average net tuition in our sample.

The coefficient on year indicates that net tuition increased by about \$2 to \$62 a year at public institutions in the Midwest region between 1983 and 1996, or about 1 to 3 percent per year. However, interactions between year and region indicate that tuition increases have been higher in the Northeastern parts of the country. For private universities, tuition increased each year by about \$414 more than public universities annually, or about 4 percent more per year. Moreover, tuition at top-ranked universities also increased at a more rapid rate. In the specification without the Pell grant interactions, for example, tuition rose by \$705 more per year at top-ranked schools.

The estimated effects of Pell grants on tuition vary both for the OLS and fixed-effects regressions and for the interacted and non-interacted specifications. Consider, first, the non-interacted specifications. The coefficient on Pell in the OLS results is negative and significant, suggesting that institutions with higher average per-student Pell grants charge lower tuition. However, this result appears to arise from unobserved heterogeneity, since the coefficient on Pell is positive (but not significant) in the corresponding fixed-effects specification. This difference between the OLS and fixed-effects results may indicate that needy students tend to enroll at relatively lower-cost universities.

Consider, next, the interactive specifications. In the OLS results, the coefficients are insignificantly negative for top-ranked schools and significantly negative for lower-ranked schools. The larger negative coefficient for lower-ranked schools may arise because needy students receiving Pell grants are more likely to attend lower ranked (and lower-cost) schools. This negative effect disappears in the corresponding fixed-effects specification with interactions,

where there are controls for unobserved heterogeneity. Neither coefficient differs significantly from zero in the FE specification.

Instrumental-variable regressions

While our results provide no empirical support for the Bennett hypothesis, the potential endogeneity of Pell grants may obscure the true relationship. The Pell grant formula uses cost of attendance to calculate a student's award, and the tuition of a school will then be positively correlated with the level of the Pell grant – yielding an upward bias on the coefficient for Pell grants. The potential endogeneity 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. Moreover, needy, Pell grant recipients may be less likely to enroll in universities where tuition is rising more rapidly than average, yielding a negative bias to the coefficient for Pell grants.

To examine potential endogeneity and any consequent bias, we apply several alternative instrumental variable strategies. First, we reestimate the fixed-effects specifications using both a set of variables for changes in the parameters for the Pell program and the lagged value of Pell grants as instruments for its contemporaneous value.⁶ As suspected, endogeneity is indicated by the relevant Hausman test, which rejects the null hypothesis of exogeneity for Pell grants at the five percent level with an $F(1,726)$ statistic of 6.22. This approach has the advantage of a strong set of instruments, with natural experiment variation from changes in the Pell grant program and also the lagged value of the average Pell grant (the lagged and contemporaneous values of Pell are highly correlated, with a correlation coefficient of 0.942),

⁶Instruments include the lag of Pell and four binary variables that reflect exogenous government changes in the Pell program in particular years: the “percent cost rule” that mandated the maximum percentage of tuition costs that could be covered by Pell grants was raised from 50 to 60 percent in 1985 and 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 1986 and in 1990. In specifications with interactions with the top 100 variable, instruments also include interactions between these four binary variables and the rank variable.

but the disadvantage of a correlation between the instrument and the error term induced by the mean differencing in the fixed-effects estimator. The bias in this case is inversely related to the number of time-series observations in each cross-sectional unit. In our data, the typical number of observed years is about a dozen, suggesting a small but possibly non-trivial bias. For this reason, we also discuss estimates based on alternative instruments, including changes in the Pell program parameters alone.

The instrumental variable estimates for the fixed-effects specification are presented in the last two columns of Table 2. Consider first the coefficient in the non-interacted specification in the next to last column. Counter to any anticipated bias arising from the funding formula, the coefficient in the IV specification is larger than in the simple fixed-effects specification and now significantly positive.⁷ Thus, the potential endogeneity between Pell grants and tuition does appear to impart a negative bias in the FE specification. In the IV specification, each dollar increase in average Pell grant per recipient is associated with a significant increase in net tuition of \$1.20, insignificantly greater than one.

Turning now to the interacted specification in the last column of Table 2, we find that the Pell coefficient for top 100 universities increases to \$1.47, significantly greater than zero but not one. The Pell coefficient for universities outside the top 100 is insignificantly different from zero. Thus, the fixed-effects IV results appear to provide even stronger support for the Bennett hypothesis, at least among the very best U.S. universities. If one uses only the changes in the Pell program over the period as instruments (or lag 2 of the Pell variable instead of lag 1), the coefficient for the top 100 universities is modestly larger, not smaller. Thus, in the IV estimates we find significant support for the Bennett hypothesis, particularly among the universities ranked

⁷Li (1999) also uses the CASPAR data and employs simulated instruments based on the variation in tuition that arises from exogenous changes in the federal provision of Pell grants. Similar to our findings, Li's results also show that instrumenting tends to increase the magnitude of the coefficient on Pell grants.

among the top 100. On average, these universities appear to raise net tuition by the full amount of the Pell grant subsidy, but not by more than one-for-one, which would provide evidence of price discriminating behavior. Below, we examine this evidence further by distinguishing between public and private universities.

Public versus private universities

Public and private universities face different constraints, may have different objectives, and are likely to vary in other critical ways that might be important in how tuition responds to changes in levels of Pell grants. Results from the IV fixed-effects regressions for public and private universities are presented in Table 3, where for brevity only the coefficients for the Pell variables and interactions are presented. Estimates for public universities provide no support for the Bennett hypothesis, regardless of rank.⁸ This failure to accept the Bennett hypothesis for public universities is consistent with the recent findings of Rizzo and Ehrenberg (2003).

However, the results for private universities appear to provide evidence of a significantly positive effect of Pell aid on net tuition. Specifically, the non-interacted specification indicates that private universities increase tuition by \$3.96 for each dollar in Pell aid, or by significantly more than one-for-one.⁹ The interacted specification suggests that this effect may be attributed exclusively to the top-ranked private universities. In particular, the top-ranked private institutions appear to increase net tuition by \$4.25 for each dollar in Pell grants, a roughly 5 percent increase in net tuition for every 10 percent increase in Pell aid.¹⁰ As with the pooled IV estimates in Table 2, use of the changes in the Pell program alone (or lag 2 of Pell instead of lag 1) yields larger, not smaller estimates of the effect of Pell aid.

⁸Estimated Pell coefficients are also not significantly positive if out-of-state net tuition is used instead.

⁹The Pell coefficient of 3.96 is significantly greater than one at the five percent level (t-statistic of 2.31).

¹⁰The Pell coefficient of 4.25 is significantly greater than one at the five percent level (t-statistic of 2.50).

Previous studies providing evidence in support of the Bennett hypothesis typically do not consider the influence of market power on how universities respond to changes in Pell aid. Here, the separate results for public and private universities, distinguished by market rank, suggest that previous positive results may be driven primarily by the behavior of the top-ranked, elite private universities. Thus, our results are consistent with both those of Rizzo and Ehrenberg (2003), who reject the Bennett hypothesis for public universities, and those of Netz (1999), who finds that internally provided need-based aid substantially increases tuition at elite private universities in the “Ivy Overlap Group” which coordinates criteria for providing need-based aid.

Alternative specifications

One might worry that the strong link between Pell aid and tuition at top-ranked private universities arises as the result of some unobserved factor influencing both Pell and net tuition. Cost inflation, for example, might lead to common percentage increases, and thus larger absolute increases in tuition at higher priced, elite private universities. While the role of an unobserved factor can never be ruled out, this possibility appears unlikely in the present case for a number of reasons. The estimated specifications all include interactions between a time trend and the rank variables, so any effects of trended factors are permitted to differ by market rank. We estimate specifications with individual year effects, as well, with similar results. Finally, our results are reinforced by their consistency with the Netz study of internal, need-based aid at top-ranked private schools.

Another potential factor, though, is the variation in the proportion of students who receive Pell aid. To explore the possible role of these variations, we reestimate the IV specifications in Table 3, but with the proportion of students receiving Pell aid included as an explanatory

variable. We instrument for this variable, as well as for the average Pell grant.¹¹ The results in Table 4 are similar to those in Table 3, with the coefficients on Pell aid insignificant for public universities and the coefficient on Pell aid for top 100 private universities significantly positive and roughly the same magnitude (3.99) as in Table 2 (4.25). Coefficients on the proportion of Pell recipients are insignificant for public universities, but significantly positive (0.26) for private universities.¹² Hence, inclusion of the proportion of students receiving Pell does not substantively alter our findings, though they suggest a second potential role for the Pell program in pushing net tuition upward. Other studies have typically used Pell aid per student, rather than per recipient, which confounds the effects of changes in Pell aid per recipient with changes in the proportion of students who receive Pell aid.

Overall, then, we find that Pell grants are not associated with higher levels of net tuition at public universities or at lower ranked private universities. In contrast, among top-ranked private universities each dollar of Pell aid is associated with a net increase in tuition of much more than a dollar, roughly \$4, significantly greater than the one-for-one *maximum* implied by either the competitive or simple monopoly explanation. The most expedient explanation for this finding is price-discriminating behavior among top-ranked private universities. Indeed, complementary evidence in Long (2002) on the Georgia Hope Scholarship program also suggests also suggests tuition increases for nonrecipients.¹³ This explanation, though, is more complex than the simple Bennett hypothesis.

Interpretation and discussion

¹¹We use the same primary and alternative instrument sets as for Pell aid per recipient.

¹²Interacting the proportion of Pell recipients with the rank variables indicates that this positive effect is also concentrated among the top-ranked universities, and yields a virtually identical coefficient for Pell aid for the top-ranked group (3.78, s.e. 1.01).

¹³Of course, the Hope Scholarship program in Georgia only applies to Georgia residents, whereas the Pell program applies nationwide.

One possible interpretation is that top-ranked private universities charge wealthier students higher tuition simply in order to subsidize the tuition of less well-to-do students who might not otherwise be able to attend, expanding access for these needy students. However, when evidence of price discrimination is unambiguous (i.e., when increases in Pell grants are matched more than one-for-one by increases in net tuition), price discrimination is also not purely redistributive. Apparently, the increased tuition revenue is not used simply to improve access for less well-to-do students by lowering net tuition.

This conclusion is reinforced in Table 4, where we add the proportion of Pell recipients as a measure of access for needy students. Even with variations in the proportion of Pell recipients held constant, Pell aid is still associated with a greater than one-for-one increase in average net tuition for top-ranked private universities.¹⁴ Lacking individual data in the present analysis, though, we are not able to discern directly the extent to which net tuition for individual Pell recipients attending these schools may rise. However, the Netz (1999) study of elite private schools found that increases in internally provided need-based aid were at least partially offset by significant increases in tuition for both recipients and non-recipients. Moreover, the proportion of Pell recipients at top-ranked private universities is barely a half to two-thirds that of other private and public universities, respectively. In any event, average net tuition appears to rise sharply overall, by more than one-for-one – even when variations in the proportion of students who receive Pell aid are held constant.

¹⁴Price discrimination might still increase the total number of students, even if the proportion of Pell recipients stays the same. A substantial increase, though, appears inconsistent with the relatively stable size of most top-ranked private universities. Also, even standard models of “market segment” price discrimination do not necessarily – at least to a linear approximation – predict that total output increases above even the monopoly level (e.g., Hadar, 1971, p. 86).

VI. Concluding remarks

Based on a rich set of data for a panel of universities between 1983 and 1996, we find no evidence in support of the Bennett hypothesis among public or lower-ranked private universities. For these universities, increases in Pell aid do not appear to be associated with significant increases in net tuition, i.e., average tuition less other student aid. Among the best private universities, though, we find strong evidence of sharp increases in net tuition associated with increases in Pell aid. For these universities, net tuition rises by even more than the increase in aid. The behavior most consistent with this result is price discrimination, where an increase in aid to needy students with relatively elastic demand induces a sharp increase in tuition for other students with less elastic demand.

It is perhaps ironic in the context of the original Bennett hypothesis, that in the price discrimination scenario the sharpest increases in tuition appear to be for students who do *not* receive Pell grants, though we are able to infer individual effects only indirectly in our data. Even so, the effects we find do not appear to be mere redistributions from wealthier students to needier students, since net tuition – average tuition less other student aid – rises by more than one-for-one with each dollar of Pell aid, even with variations in the proportion of Pell recipients held constant.

Tuition increases at public universities or lower ranked private universities – by far the larger group of universities – appear minimal in response to increase in Pell grants. In these cases, the goal of the Pell program of expanding enrollments with little or no tuition increase appears to be achieved. Thus, the strong effects on net tuition we find among the relatively small set of top-ranked private universities does not support the general conclusion that Pell grants put strong upward pressure on net tuition at the vast majority of universities. Furthermore, the strongest effects at top-ranked universities are presumably among the

wealthiest students. Of course, additional research, including data with individual student detail, would add further insight to these results.

References

- Acosta, R.J. (2001). "How Do Colleges Respond to Changes in Federal Student Aid?" Working Paper No. 808, Department of Economics, University of California, Los Angeles.
- Angrist, J.D. (1993). "The Effect of Veterans Benefits on Education and Earnings." *Industrial and Labor Relations Review*, 46:4, 637-52.
- Clotfelter, C.T. (1991). Demand for Undergraduate Education. In: C.T. Clotfelter, R.G. Ehrenberg, M. Getz, and J.J. Siegfried, *Economic Challenges in Higher Education*, Chicago: University of Chicago Press.
- Curs, B. & Singell, L.D., Jr. (2002). An Analysis of the Application and Enrollment Process for In-state and Out-of State Students at a Large Public University," *Economics of Education Review*, 21, 111-124.
- Duffy, E.A. & Goldberg, I. (1998). *Crafting a Class: College Admissions and Financial Aid, 1955-1994*. Princeton: Princeton University Press.
- Dynarski, S.M. (1999). "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion." Harvard University Working Paper.
- _____. (2000). "Hope for Whom? Financial Aid for the Middle Class and Its Impact on College Attendance." *National Tax Journal*, 53:3, 629-61.
- Hadar, J. (1971). *Mathematical Theory of Economic Behavior*. Menlo Park: Addison-Wesley.
- Hoенack, 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.
- Kane, T. (1994). "College Entry by Blacks since 1970: The Role of College Costs, Family Background, and the Returns to Education." *Journal of Political Economy*, 102:5 878-911.
- Leslie, L.L & Brinkman, P. T. (1987) Student Price Response in Higher Education: the Student Demand Studies. *Journal of Higher Education*, 58, 181-204.
- Li, J. (1999). "Estimating the Effects of Federal Financial Aid on College Tuition; A Study of Pell Grants," Harvard University Dissertation.
- Long, B.T. (2002). "How do Financial Aid Policies affect Colleges? The Institutional Impact of the Georgia HOPE Scholarship." Working paper. Graduate School of Education. Harvard University.
- McPherson, M.S. (1998). *The Student Aid Game*. Princeton: Princeton University Press.
- McPherson, M.S. & Schapiro, M.O. (1991). "Does Student Aid Affect College Enrollment? New Evidence on a Persistent Controversy." *American Economic Review*, 81:1, 309-18.

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

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.

Singell, L.D., Jr., (2001). "Merit, Need, and Student Self Selection: Is There Discretion in the Packaging of Aid at a Large Public University?" *Economics of Education Review*, Vol 21, 2002, pp. 445-454.

Singell, L.D. & Stone, J.A. (2001). "The Good, the Poor, and the Wealthy: Who Responds Most to College Financial Aid?" *Bulletin of Economic Research* 54:2, October 2002, pp. 393-407.

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

Table 1 Descriptive Statistics for Public, Private, and All Institutions.

Variables	All Institutions Mean (Standard Error)	Public Mean (Standard Error)	Private Mean (Standard Error)
Net Tuition ^a	6.4772 (4.9060)	1.7511 (0.9076)	10.3325 (3.1492)
State Appropriations Per Student ^a	2.7541 (3.3479)	5.8257 (2.5694)	0.2484 (0.9918)
Endowment Per Student ^a	54.3510 (80.9628)	5.6751 (12.6845)	94.0573 (90.9159)
Average SAT Score in State ^a	1.0382 (0.0615)	1.0421 (0.0647)	1.0350 (0.0588)
Year	89.9369 (3.8109)	89.8871 (3.8394)	89.9775 (0.37912)
South	0.3168 (0.4655)	0.2810 (0.4501)	0.3461 (0.4763)
West	0.2067 (0.4052)	0.3003 (0.4590)	0.1303 (0.3371)
Northeast	0.2314 (0.4220)	0.1240 (0.3300)	0.3191 (0.4667)
Universities in Top 100	0.8218 (0.3829)	0.7025 (0.4578)	0.9191 (0.2730)
Private University	0.5507 (0.4977)	0.0000 (0.0000)	1.0000 (0.0000)
Pell Grant Per Recipient ^a	1.3787 (0.2758)	1.3590 (0.3002)	1.3947 (0.2535)
Number of Observations	808	363	445

a - Variable is defined in units of a thousand.

Table 2 Net Tuition Regressions

Variables (Nobs=808)	Ordinary Least Squares		Fixed Effects		Fixed Effects IV	
	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)
Constant ^b	-0.6723** (0.0037)	-0.6731** (0.0037)	-0.7078** (0.0023)	-0.7082** (0.0023)	-0.6317** (0.0040)	-0.6209** (0.0040)
State Approp. Per Student ^a	-0.0800** (0.0339)	-0.0894** (0.0339)	-0.1111** (0.0557)	-0.1104** (0.0557)	-0.0974* (0.0585)	-0.0920 (0.0595)
Endowment Per Student ^a	-0.0052** (0.0010)	-0.0054** (0.0009)	-0.0117** (0.0014)	-0.0117** (0.0013)	-0.0125** (0.0015)	-0.0127** (0.0015)
Average SAT Score in State	-0.0024** (0.0013)	-0.0023* (0.0013)	0.0133** (0.0027)	0.0132** (0.0027)	0.0142** (0.0028)	0.0140** (0.0029)
Year	0.3402** (0.0191)	0.3414** (0.0190)	0.0021 (0.0273)	0.0618** (0.0212)	-0.0519 (0.0365)	-0.0422 (0.0462)
(South)*(Year)	-0.0006** (0.0001)	-0.0006** (0.0001)	0.0133 (0.0211)	0.0128 (0.0253)	0.0204 (0.0221)	0.0195 (0.0226)
(West)*(Year)	-0.0001 (0.0001)	0.0001 (0.0001)	0.0708** (0.0247)	0.0705** (0.0250)	0.0754** (0.0264)	0.0756** (0.0270)
(Northeast)*(Year)	0.0009** (0.0001)	0.0010** (0.0001)	0.1963** (0.0246)	0.1959** (0.0244)	0.2103** (0.0260)	0.2108** (0.0264)
(Private)*(Year)	0.0040** (0.0001)	0.0040** (0.0001)	0.4138** (0.0211)	0.4141** (0.0211)	0.4270** (0.0225)	0.4302** (0.0232)
(Top 100)*(Year)	0.0006** (0.0001)	-0.0004 (0.0004)	0.7050** (0.0216)	0.0654** (0.0265)	0.7176** (0.0225)	
Pell ^a	-0.4488* (0.2588)	-	0.0820 (0.1472)	-	1.2023** (0.4994)	-
(Pell)*(Top 100) ^a	-	-0.1379 (0.2818)	-	0.1036 (0.1595)	-	1.4727** (0.5911)
(Pell)*(Not Top 100) ^a	-	-1.6711** (0.5165)	-	-0.0282 (0.3657)	-	0.9371 (0.8639)
R-Squared	0.8821	0.8821	0.9043	0.9043	0.9040	0.8999

** (*) significant at the five (ten) percent level.

a - Variable is defined in units of a thousand.

b - Constant and standard error are divided by 1000.

Table 3 Net Tuition Regressions for Public and Private Universities^a

Variables	Public (Nobs=363)		Private (Nobs=445)	
	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)
Pell	0.0425 (0.2209)	-	3.9596** (1.2793)	-
(Pell)*(Top 100)	-	-0.0095 (0.2764)	-	4.2505** (1.2975)
(Pell)*(Not Top 100)	-	0.3955 (0.3105)	-	-1.7370 (4.4713)

** (*) significant at the five (ten) percent level.

a - The specification includes the same explanatory variables as the regressions in Table 2 with the exception that (private)*(year), which is excluded. The Pell variables are defined in units of a thousand.

Table 4 Net Tuition Regressions for Public and Private Universities with Proportion Pell^a

Variables	Public (Nobs=363)		Private (Nobs=445)	
	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)	Coeff. (Std. Er.)
Pell	0.0851 (0.1796)	-	3.7053** (0.9608)	-
(Pell)*(Top 100)	-	-0.0717 (0.2560)	-	3.9888** (1.0628)
(Pell)*(Not Top 100)	-	0.4421 (0.3044)	-	-0.5444 (4.0037)
Proportion of Students with Pell	-0.0069 (0.0164)	-0.0171 (0.0177)	0.2610** (0.0782)	0.2620** (0.0791)

** (*) significant at the five (ten) percent level.

a - The specification includes the same explanatory variables as the regressions in Table 2 with the exception that (private)*(year), which is excluded. The Pell variables are defined in units of a thousand.