For Whom the Pell Tolls:  
A Test of the Bennett Hypothesis  

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Abstract

Several former Secretaries of Education, beginning prominently with William Bennett in the 1980s, have expressed concern that increases in federal support do not lower college expenses for students, but are appropriated by universities through increases in tuition. This view has become known as the “Bennett hypothesis.” Based on a rich set of data for a panel of universities between 1983 and 1996, we find strong evidence in support of the Bennett hypothesis, at least among the best private universities. For these universities, increases in Pell aid are more than matched by tuition increases, so that the rise in tuition exceeds 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 sharply higher tuition increase for other students with less elastic demand. Tuition increases at public universities or lower ranked private universities appear minimal in response to increases in Pell grants.
"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 segments of the population. 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 data for a panel of universities between 1983 and 1996 to test the Bennett hypothesis. Based on these detailed data, we find formal evidence that increases in federally subsidized aid (in this case, Pell grants) are positively linked to increases in tuition, at least at the best private universities. Indeed, we find that for these universities, each increase in aid is more than matched by tuition increases, so that tuition rises by even more than the increase in aid. We explore several explanations for this finding.
The analysis focuses on 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). Under the Bennett hypothesis, Pell grants ought to yield a larger tuition increase because they increase student resources more directly than loans. Finally, 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.

II. The Bennett Hypothesis

Even without turning to idiosyncratic organizational models of university behavior (as in Hoenack and Pierro, 1990), 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 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 aid per student. 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 but not tuition would increase.
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 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 tuition increases for elite, exclusive universities, since they have greater market power. Even in this case, though, tuition increases at most by the full amount of the increased aid per student, all else the same.

A third explanation rests on 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, tuition for each type to student is set to equate marginal revenue in each case to the common marginal cost (where there are no cost differences). In this case, the tuition 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 tuition for the market with relatively less elastic demand can exceed the increased aid amount. Similar implications hold for average or net tuition, i.e., tuition net of the increased financial aid.

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 both fixed university effects in the panel data and a richer set of control variables important to university enrollment and tuition policies.

Aside from these few tests, other studies of financial aid have focused primarily on demand-side effects. Leslie and Brinkman (1987) survey early enrollment studies that use aggregate time-series 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 overall 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 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 ($P_{it}$):

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

(1)

The coefficients $\alpha, \phi, \beta, \gamma, \delta$, and $\phi$ represent parameter vectors for each category of explanatory variables. The university-specific fixed effect, $\mu_i$, controls for unobserved university-specific
differences in tuition, whereas a 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, \( \mu_i \).

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 interactions between Pell grants and measure of market power in equation (2):

\[
T_\text{a} = \alpha F_\text{a} + \beta t + \gamma (tU_i + V_\text{a}) + \delta M_\text{a} + \phi P_\text{a} + \lambda P_\text{m}M_\text{a} + \mu_i + \varepsilon_\text{a}
\]

(2)

The coefficient on the interaction between \( P_\text{m} \) and \( M_\text{a} \), \( \bar{\varepsilon} \), measures the difference in the response of tuition to changes in Pell grants by universities with different 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.¹ 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 and the annual average SAT scores.

**Tuition and other revenues**

Tuition is measured by the list tuition per student, denominated in thousands of dollars. List tuition is frequently not the actual price paid for college because federal, state, and institutional aid lower the true out of pocket costs for each student. We focus on the list price since this is the tuition identified by the Bennett hypothesis, but also estimate specifications for

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¹The requirement of complete data results in dropping 23 universities. These have an average academic rank of 89 versus 60 for the 71 universities with complete data.
net tuition, as well – where net tuition is defined as list tuition minus financial aid.\(^2\) For public universities, tuition also differs between in-state and out-of-state students. Most students at public universities are from the home state, and the analysis focuses on average in-state tuition for public universities. Even so, we also estimate specifications 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 the price. 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 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. List tuition may be negatively related to the per-student endowment level if universities use donor funds to offset tuition. However, institutions with relatively large endowments may also be relatively costly to run, either due to otherwise unobserved differences in quality or because many gifts are restricted to specific purposes.

\(^2\)Li (1999) also estimates the effects of Pell grants on both list and net tuition, with qualitatively similar results. However, including elements of the financial aid package on both the right- and left-hand-sides of the model may be problematic, since prior work suggests that components of the aid package are jointly determined (Singell, 2001).
Time trends and university attributes

The model includes a time trend (1983=1) to control for time varying factors such as changes in the price level over time. 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. 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

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 three broad categories for premier universities ranked in the top 50, universities ranked between 51 and 100, and the excluded 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. These (time-invariant) rank variables are interacted with the time trend, which permits variation in tuition growth between qualitatively different universities.

**Pell grants**

Again, the Bennett hypothesis suggests that the per-student level of federal financial aid will have a direct positive relationship with tuition because universities respond by charging higher tuition. As a consequence, we include the per-student level of Pell grant in the model. To examine whether the response varies with the degree of market power, we also estimate specifications (following from eq. 2) that include an interaction of Pell grants with the rank variables. The coefficients on these interaction terms are expected to increase for higher ranked universities (e.g., a larger effect for universities in the top 50).

**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 tuition nearly doubled between the first and second half of the sample, and that average tuition at private institutions is almost six times as high as at public institutions. As expected, state appropriations and endowments have increased over time at both public and private universities; public universities receive more state support; and private universities have larger endowments. The average Pell grant per student has also increased over time, but at a rate far below that of tuition increases. Despite higher tuition at private universities, students at public universities receive a higher level of Pell support, which reflects that needy students are more likely to attend public universities. In addition, in this sample, private universities have a relatively higher representation in both the top 50 and the below top 100 ranked institutions.
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 per-student 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 regression. A million dollar increase in state appropriations (total endowment) is associated with a decrease in tuition of about $136 to $139 ($3). Thus, the results suggest that greater external support by government and private donors is associated with a net reduction in tuition. Institution-specific differences in demand or other factors appear to be particularly important with regard to endowments, because the coefficient on endowments is positive (though insignificant) in the OLS results, where these differences are not controlled. The coefficient on state SAT scores is positive, but insignificant.

The coefficient on year indicates that tuition increased by about $105 to $125 a year at public institutions in the Midwest region between 1983 and 1996, a rate of roughly 4 to 5 percent per year expressed as a percentage of the average tuition at public universities over the period. However, interactions between year and region indicate that tuition increases have been higher in the Western and the Northeastern parts of the country. For private universities,
tuition increased each year by $724 to $730 more than public universities annually, a rate of 6 to 7 percent over the same period. Moreover, tuition at top-ranked universities also increased at a more rapid rate. In the non-interacted specification, the "top 50" universities increased tuition each year by $106 more than those ranked outside the top 100, and those ranked between 51 and 100 increased tuition by $69 more.

Results for the 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 for top-ranked schools are significantly negative. In this instance, the negative coefficient may arise because needy students receiving Pell grants are more likely to attend lower ranked (and lower-cost) schools. This negative Pell effect again turns positive in the corresponding fixed-effects specification with interactions, where there are controls for unobserved heterogeneity. The fixed-effects regressions indicate that tuition at universities ranked in the top 50 increased by $4.31 (i.e., the interactive effect of $5.10 less the direct effect of minus $0.79) for every dollar of Pell grant per-student. Stated differently, tuition increased an average of about 5 percent for each $100 of Pell grant support per student in top 50 universities. The coefficient for the universities rank from 51 to 100 is not significant.
Based on these estimates, support for the Bennett hypothesis is strong and statistically significant among the top-ranked universities when unobserved heterogeneity is controlled, but not elsewhere. Indeed, the effect of an increase in Pell grant aid per student on tuition among top-ranked universities significantly exceeds one, i.e., increases by more than dollar with each dollar increase in Pell aid per student. This result most closely supports the price-discrimination explanation, where the increase in demand among needy students with relatively elastic demand results in tuition rising overall by even more than the increase in aid.\(^3\)

**Instrumental-variable regressions**

While our results provide significant support for the Bennett hypothesis, at least among top-ranked universities, the potential endogeneity of Pell grants may falsely exaggerate a positive effect on tuition. In particular, 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 caps in the formula. Another concern is that 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 reestimate the fixed-effects specifications using the lagged value of Pell grants as an instrument for its contemporaneous value. The lagged value serves as a natural instrument in this case.

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\(^3\)If one substitutes net tuition for list tuition and repeats the fixed-effects estimation of the interactive specification, the results are strikingly similar to those for list tuition. Net tuition at top-ranked universities rises by $4.69 (an interactive effect of $5.99 less the direct effect of minus $1.31), roughly the same as for list tuition.
because the variation in Pell grants from the previous year is not likely to correlated with the unexplained variation in current tuition. Use of the lagged value of Pell grants as an instrument yields fewer observations because the lagged value of Pell cannot be calculated for the first observation in the sample. For comparable estimates, we present both fixed-effects and IV fixed-effects estimates for the smaller sample in Table 3, so that any differences can be attributed to the estimators rather than to the samples. Coefficients on the other explanatory variables are omitted for brevity because they are similar to those in Table 2.

For both sets of estimates in Table 3, the magnitudes of the coefficients on the Pell variables are larger with a higher level of significance than those in Table 2. Counter to any anticipated bias arising from the funding formula, the coefficients in the IV specification are larger (but not statistically different) than in the simple fixed-effects specification. Thus, the potential endogeneity between Pell grants and tuition does not appear to account for the positive relationship found in the previous specification. Indeed, a Hausman endogeneity test yields F-statistics of 0.79 and 0.36 for the non-interacted and the interacted specifications, failing to reject the null hypothesis that Pell grants are exogenous. The failure to reject exogeneity does not appear to be due to a weak instrument, since the lagged value of Pell grants is highly correlated with its contemporaneous value.

Results from the IV specification indicate that each dollar increase in average Pell grant per student is associated with an increase in tuition of $7.16 ($2.12) at universities ranked in the top 50 (between 51 and 100). Stated differently, tuition in top 50 (51-100) universities increases by about 7.0 (2.0) percent with an increase of $100 in the average Pell grant per

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4 Li (1999) also uses the CASPAR data, but employs the technique of simulated instruments. This technique filters out possible endogenous effects by only using the variation in tuition that arises from exogenous changes in the federal provision of Pell grants. Similar to our findings in Table 3, Li's results also show that instrumenting increases the magnitude of the coefficient on Pell grants.
student. Thus, the IV results provide even stronger support for the Bennett hypothesis, at least among the very best U.S. 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. To examine this possibility, the fixed effects specifications in Table 2 are re-estimated separately for public and private universities. For public universities, fixed-effects regressions are estimated using both in-state and out-of-state tuition, to examine if universities respond differently for in-state and out-of-state students, e.g., due to differences in the relative demand elasticities.\(^5\) However, in-state tuition is used for private universities simply because the data show that these institutions do not typically differentiate tuition charges by state of residence. Given the results of the last section, in which we could not reject the exogeneity of Pell grants, we do not present separate IV estimates for public and private universities.

Results from the fixed-effects regressions for public and private universities are presented in Table 4, 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. In fact, the only significant result in the set of estimates for public universities suggests a negative relationship between Pell aid and out-of-state tuition for top-ranked public universities. A likely explanation, even in the fixed-effects specification, is that out-of-state access to these elite public universities is related to otherwise unobserved factors over time inversely related to both the likelihood of receiving and the level of Pell aid.

\(^5\)Curs and Singell (2001) use data for a large public university and find that the enrollment demand for out-of-state students is elastic, whereas it is inelastic for in-state students.
However, the results for private universities provide strong support for the Bennett hypothesis that tuition increases with the level of Pell grants and that top 50 institutions increase tuition more than those ranked below them. Specifically, the non-interacted specification indicates that private universities increase tuition by $3.38 for each dollar in average, per-student Pell grants. The interacted specification indicates that this effect can be attributed exclusively to the top-ranked private universities. In particular, the top-ranked private institutions increase tuition by $9.49 (the indirect effect of $8.01 plus the direct effect of $1.48) for each dollar in Pell grants, roughly 9 percent for every $100 in average, per-student Pell grants provided by the federal government.

Previous studies providing evidence in support of the Bennett hypothesis typically pool public and private universities and do not consider the influence of market power. Here, the separate results for public and private universities, distinguished by market rank, suggest that previous results may be driven by the behavior of the top-ranked, elite private universities. Even so, public and private institutions are not proportionately distributed across the three qualitative rank categories, with only small number of one type in some of the categories. This is particularly pronounced for public universities in the top group, with only 12 of the 38 in the top 50 in our sample. For this reason, we are cautious in completely attributing the support for the Bennett hypothesis to elite private universities.

VI. Concluding remarks

Based on a rich set of data for a panel of universities between 1983 and 1996, we find strong evidence in support of the Bennett hypothesis, at least among the best private universities. For these universities, increases in Pell aid are more than matched by tuition increases, so that 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. In this scenario, tuition net of the Pell grant declines for Pell recipients, leading to an increase in their enrollment and a decrease in enrollment for students with less elastic demand as they end up paying sharply higher tuition – higher even than the increase in the Pell grant.

Ironically, in the price discrimination scenario the sharpest increases in tuition may be for students who do not receive Pell grants, though we are able to infer individual effects only indirectly in our data. Furthermore, tuition increases at public universities or lower ranked private 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 may be achieved. Thus, the strong evidence we find for the Bennett hypothesis among the small set of top-ranked private universities does not support the general conclusion that Pell grants put strong upward pressure on tuition at most universities.
References


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<td>0.2125 (0.4096)</td>
<td>0.2009 (0.4012)</td>
<td>0.2997 (0.4587)</td>
<td>0.1304 (0.3371)</td>
</tr>
<tr>
<td>Northeast (=1)</td>
<td>0.2318 (0.4222)</td>
<td>0.2215 (0.4157)</td>
<td>0.2425 (0.4012)</td>
<td>0.1259 (0.3322)</td>
<td>0.3188 (0.4665)</td>
</tr>
<tr>
<td>Private (=1)</td>
<td>0.5489 (0.4979)</td>
<td>0.5436 (0.4987)</td>
<td>0.5543 (0.4976)</td>
<td>0.0000 (0.0000)</td>
<td>1.0000 (0.0000)</td>
</tr>
<tr>
<td>Pell grants per studenta</td>
<td>0.1655 (0.0947)</td>
<td>0.1442 (0.0850)</td>
<td>0.1875 (0.0992)</td>
<td>0.1997 (0.0953)</td>
<td>0.1374 (0.0846)</td>
</tr>
<tr>
<td>Top 50 Rank (=1)</td>
<td>0.5364 (0.4990)</td>
<td>0.5503 (0.4980)</td>
<td>0.5219 (0.5001)</td>
<td>0.3426 (0.4752)</td>
<td>0.6957 (0.4606)</td>
</tr>
<tr>
<td>Rank 50 to 100 (=1)</td>
<td>0.2852 (0.4518)</td>
<td>0.2796 (0.4493)</td>
<td>0.2910 (0.4547)</td>
<td>0.3602 (0.4807)</td>
<td>0.2236 (0.4171)</td>
</tr>
<tr>
<td>Number of Universities</td>
<td>71</td>
<td>71</td>
<td>71</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>Nobs</td>
<td>880</td>
<td>447</td>
<td>433</td>
<td>397</td>
<td>483</td>
</tr>
</tbody>
</table>

a - In units of a thousand.
b - In units of a million.
Table 2  OLS and Fixed-Effects Regressions for Tuition

<table>
<thead>
<tr>
<th>Variables (Nobs=880)</th>
<th>OLS Without Pell/Rank Interactions</th>
<th>OLS With Pell/Rank Interactions</th>
<th>Fixed Effects Without Pell/Rank Interactions</th>
<th>Fixed Effects With Pell/Rank Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Std. Error)</td>
<td>(Std. Error)</td>
<td>(Std. Error)</td>
<td>(Std. Error)</td>
</tr>
<tr>
<td>State appropriations per student</td>
<td>-0.1888&quot; (0.0402)</td>
<td>-0.1518&quot; (0.0418)</td>
<td>-0.1387&quot; (0.0416)</td>
<td>-0.1360&quot; (0.0414)</td>
</tr>
<tr>
<td>Total eEndowment per student</td>
<td>0.0013 (0.0011)</td>
<td>0.0013 (0.0011)</td>
<td>-0.0030&quot; (0.0011)</td>
<td>-0.0031&quot; (0.0011)</td>
</tr>
<tr>
<td>SAT Scores</td>
<td>0.2012 (1.4880)</td>
<td>0.6920 (1.4915)</td>
<td>3.2897 (2.1100)</td>
<td>2.7328 (2.1038)</td>
</tr>
<tr>
<td>Year</td>
<td>0.5582&quot; (0.0188)</td>
<td>0.5472&quot; (0.0191)</td>
<td>0.1053&quot; (0.0201)</td>
<td>0.1258&quot; (0.0218)</td>
</tr>
<tr>
<td>Year*South</td>
<td>-0.0100&quot; (0.0025)</td>
<td>-0.0101&quot; (0.0025)</td>
<td>-0.0135 (0.0153)</td>
<td>-0.0203 (0.0154)</td>
</tr>
<tr>
<td>Year*West</td>
<td>0.0039 (0.0026)</td>
<td>0.0042 (0.0026)</td>
<td>0.0357&quot; (0.0185)</td>
<td>0.0285 (0.0186)</td>
</tr>
<tr>
<td>Year*Northeast</td>
<td>0.0208&quot; (0.0028)</td>
<td>0.0215&quot; (0.0028)</td>
<td>0.1333&quot; (0.0174)</td>
<td>0.1298&quot; (0.0173)</td>
</tr>
<tr>
<td>Year*Private</td>
<td>0.0961&quot; (0.0030)</td>
<td>0.0974&quot; (0.0031)</td>
<td>0.7242&quot; (0.0157)</td>
<td>0.7296&quot; (0.0158)</td>
</tr>
<tr>
<td>Year*(Top 50 Rank)</td>
<td>0.0168&quot; (0.0028)</td>
<td>0.0297&quot; (0.0055)</td>
<td>0.1064&quot; (0.0179)</td>
<td>0.0719&quot; (0.0216)</td>
</tr>
<tr>
<td>Year*(Rank 51 to 100)</td>
<td>0.0082&quot; (0.0025)</td>
<td>0.0240&quot; (0.0063)</td>
<td>0.0685&quot; (0.0169)</td>
<td>0.0562&quot; (0.0207)</td>
</tr>
<tr>
<td>Pell grants per student</td>
<td>-4.3551&quot; (0.9510)</td>
<td>-1.2811 (1.3787)</td>
<td>0.8023 (1.6667)</td>
<td>-0.7850 (1.0263)</td>
</tr>
<tr>
<td>Pell*(Top 50 Rank)</td>
<td>-5.5648&quot; (2.1929)</td>
<td>- (2.1929)</td>
<td>- (2.1929)</td>
<td>5.1036&quot; (1.5786)</td>
</tr>
<tr>
<td>Pell*(Rank 51 to 100)</td>
<td>-5.9885&quot; (2.3773)</td>
<td>- (2.3773)</td>
<td>- (2.3773)</td>
<td>0.5127 (1.5176)</td>
</tr>
<tr>
<td>Constant</td>
<td>-46.8583&quot; (2.1491)</td>
<td>-47.4272&quot; (2.1510)</td>
<td>-49.8310&quot; (2.1622)</td>
<td>-49.0916&quot; (2.1597)</td>
</tr>
<tr>
<td>R² (Within for Fixed Effects)</td>
<td>0.9083</td>
<td>0.9093</td>
<td>0.9582 (2.1622)</td>
<td>0.9588 (2.1597)</td>
</tr>
</tbody>
</table>

* (**) - Indicates significance at the 10 (5) percent level.
Table 3  Fixed-Effects and IV-Fixed-Effects Regressions for Tuition

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pell (per student enrolled)</td>
<td>0.6308</td>
<td>-2.1189</td>
<td>0.5940</td>
<td>-2.4800*</td>
</tr>
<tr>
<td></td>
<td>(1.4064)</td>
<td>(1.4304)</td>
<td>(0.7079)</td>
<td>(0.9731)</td>
</tr>
<tr>
<td>Pell*(Top 50 Rank)</td>
<td>-</td>
<td>9.3767**</td>
<td>-</td>
<td>8.3924**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.1449)</td>
<td></td>
<td>(1.4619)</td>
</tr>
<tr>
<td>Pell*(Rank 51 to 100)</td>
<td>-</td>
<td>4.5324**</td>
<td>-</td>
<td>2.6608*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.5192)</td>
<td></td>
<td>(1.3517)</td>
</tr>
<tr>
<td>R²</td>
<td>0.9547</td>
<td>0.9567</td>
<td>0.9547</td>
<td>0.9564</td>
</tr>
</tbody>
</table>

* (**) - Indicates significance at the 10 (5) percent level.
a - The fixed-effects specifications replicate those in Table 2 using the 809 observations used in the IV-Fixed-Effects specifications in columns 1 and 2 of Table 3.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Public: Instate</th>
<th>Public: Out-of-State</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Std. Error)</td>
<td>(Std. Error)</td>
<td>(Std. Error)</td>
</tr>
<tr>
<td>Pell (per student)</td>
<td>-0.5796</td>
<td>-0.5946</td>
<td>-3.5795</td>
</tr>
<tr>
<td></td>
<td>(0.3516)</td>
<td>(0.4452)</td>
<td>(0.9763)</td>
</tr>
<tr>
<td>Pell*(Top 50 Rank)</td>
<td>-0.0635</td>
<td>-1.0963</td>
<td>-2.2919</td>
</tr>
<tr>
<td></td>
<td>(0.8269)</td>
<td>(2.2919)</td>
<td></td>
</tr>
<tr>
<td>Pell*(Rank 51 to 100)</td>
<td>-0.0082</td>
<td>2.0057</td>
<td>2.3668</td>
</tr>
<tr>
<td></td>
<td>(0.8539)</td>
<td>(2.3668)</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.9023</td>
<td>0.9023</td>
<td>0.9166</td>
</tr>
<tr>
<td>Number of Obs.</td>
<td>397</td>
<td>397</td>
<td>483</td>
</tr>
</tbody>
</table>

* (**) - Indicates significance at the 10 (5) percent level.