Some new evidence of the character of competition among higher education institutions

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Abstract

This study employs a simple enrollment demand model to investigate the regional market environment of a private, church-related, comprehensive institution of higher education offering undergraduate, graduate and professional education. The focus is on price and cross-price elasticities of demand as measures of the competitive threat posed by prominent public and private educational alternatives within the region. We find a significant competitive threat coming from the private sector within the region. This competition raises the net price elasticity of demand for education at this institution to well above unity. We conclude that tuition price subsidies play a critical role in managing enrollment demand at this institution. [JEL J3, J24, J41] © 1999 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Extensive reviews of the empirical evidence of the demand for higher education by, for example, Leslie and Brinkman (1987); Becker (1990); McPherson and Shapiro (1991) show that a significant negative association exists between enrollments in higher education institutions and tuition price. This result is quite robust and can be found in national studies of the aggregate demand for education, in studies which treat private and public education as homogeneous aggregates and in studies which focus on specific, individual institutions.

Empirical evidence bearing on the character of competition between institutions is more limited. Early studies by Hopkins (1974); McPherson (1978); Knudsen and Serville (1978) using data aggregated by type of institution found little evidence of significant cross-price effects between higher education institutions.1

More recent studies conducted at the level of specific, individual institutions suggest that significant substitution relationships do exist among educational institutions. Empirical evidence reported by Seneca and Taussig (1987) shows that institutional price differentials exert a small but empirically significant influence on enrollment probabilities at Rutgers University. Vaughan and Baxter (1988) discovered significant price competition between a public four-year college (Weber State) and a state university (University of Utah). And Moore, Studenmund and Slobko (1991) report empirically significant, positive, cross-price elasticities between Occi...

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1 Notable exceptions to these early aggregate demand studies are provided by Trauchar (1969); Ghali, Miklius and Wada (1977). Each focused on specific institutions. Trauchar’s results were suggestive of limited competition between state colleges and selected Catholic colleges in California. Ghali and coworkers found no significant substitution relationships between the University of Hawaii and a composite of mainland universities and private colleges in Hawaii.
dental College and the alternative colleges of financial aid recipients.

Clearly the character of competition among higher education institutions is complex and almost certainly institution specific. To obtain further insights into the nature of competitive relationships and the structure of higher education in general we need the repeated application of enrollment demand models to specific, individual higher education institutions.2

This paper investigates the regional market environment for a private, church-related, comprehensive institution of higher education offering undergraduate, graduate and professional education. Potential competitor institutions include a public, comprehensive university located within the same metropolitan area, a public, research, doctoral-granting university located within the same state, and a private, secular, comprehensive university located in a contiguous state. All are reputed to be significant higher education alternatives for students attending the private comprehensive university that is the focus of this study.3

Our empirical results corroborate several basic conclusions cited in the empirical literature with regard to the major properties of enrollment demand. Most notably, we find a significant negative association between enrollment demand and either gross or net tuition prices, a positive income elasticity of demand confirming that private education is a normal good, and an empirically significant enrollment response to the opportunity cost of college attendance.

To these general findings we add two additional key results. First, we find the competitive threat for this private institution comes from the private sector, not the public sector. And second, we find that the presence of a significant competitor institution greatly magnifies the role of scholarships and grants in the enrollment decision. This is evidenced by a net price elasticity of demand of −1.53, implying that tuition subsidies play a critical role in managing enrollment at this institution.

2. Model and data

The model employed originates from conventional demand theory. In its simplest form, the theory holds that enrollment (E) will be negatively associated with the tuition price charged students (P) and positively associated with the real income of students (or their families) (I) and the tuition price charged by competitor institutions (Pc). To these basic economic influences we add the unemployment rate (u) to control for the availability of education alternatives (Vaughan & Baxter, 1988).

The demand equation is estimated using annual data for the period 1959–1993. We employ the dummy variables, \( D_1 = 1965–1969, \) to control for the possible influence of the Vietnam military build-ups (Lehr & Newton, 1978), and \( D_2 = 1981–1983, \) to control for the relatively pronounced recession in the early 1980s (Shim, 1990).

Formally our enrollment demand model is

\[
E(t) = a + bP(t) + cI(t - 1) + dP_c(t - 1) + eU(t - 1) + gD_1 + kD_2 + u
\]

where \( t \) denotes the \( r \)th period and 

\[
P(t) = a' + c'I(t - 1) + e'U(t - 1) + d'P_c(t - 1) + g'D_1 + k'D_2 + mC(t) + v
\]

is the first stage of a two-stage least-squares estimation procedure.4

Total undergraduate enrollment is employed as the dependent variable. This measure allows for shifting enrollment mix and more complete institutional enrollment–price response estimates than would be obtained with alternative measures such as freshman head count or full-time equivalent undergraduate enrollment.

Price variables are proxied by annual real tuition for full-time undergraduate students. Both gross price (P) and net price (PNe) measures are employed. The latter is calculated as the tuition price (P) minus the value of scholarships and grants per student (SCH).

Per capita real income, the unemployment rate and the tuition prices of potential competitors are lagged one period on the presumption that individuals respond less than instantaneously to changes in these variables.5 Income and the unemployment rate are for the state within which the institution is located.6

\( C(t) \) is an index of education costs measured by average annual real faculty salaries. Salaries are for all academic ranks at private institutions nationwide as reported in Academe by the American Association of University Professors (various issues). Data on tuition prices and total undergraduate enrollments are obtained directly

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2 This is but one of the several useful directions for empirical research on the economics of higher education. Other suggestions are provided by Wetzel, O’Toole and Peterson (1998).

3 The three potential competitor institutions are located within an area from which 55 percent of the undergraduate students are drawn.

4 The supply of enrollment places is not perfectly elastic so we cannot rule out the likely correlation of \( P \) with \( u \). Thus two-stage least-squares is an appropriate estimation method (Johnston, 1963).

5 The use of lagged variables also moderates the multicollinearity problem known to plague demand studies.

6 48 percent of the institution’s total undergraduate enrollments are state residents.
from official institutional records. Data on income and employment are from publications of the U.S. Departments of Commerce and Labor, respectively.

The expected signs of the parameters are \( b < 0 \) for a downward sloping demand curve, \( c > 0 \) for the increasing ability to finance education costs, \( d > 0 \) for substitute goods, \( e > 0 \) for the decreased availability of education alternatives, \( g > 0 \) for the draft deferment motive and \( k > 0 \) for the impact of the recession.

Enrollment demand is estimated using a log-log relation.\(^7\) This specification has several desirable and well-known properties. First, for any tuition level the enrollment predicted by the equation is positive. Second, the same proportional relationship between tuition and enrollment exists over the entire range of the demand curve. And third, the elasticity properties of enrollment demand are given by the estimated parameters of the demand equation.

3. Results

Regression results for the enrollment demand model are reported in Table 1. Coefficients of determination adjusted for degrees of freedom (\( R^2 \)), and the Durban–Watson statistics (DW), are reported as tests of the functional form.

Basic results are reported for the period 1959–1993 in Panel A of Table 1. They are quite robust and provide additional evidence on some basic, enduring relationships in student demand studies. In addition, they offer some new evidence of the character of institutional competition for a private institution. Data on scholarships and grants were available for the period 1975–1993 only. Panel B of Table 1 shows results for this period and highlights the role of net tuition price in the enrollment demand model.

3.1. Results for period 1959–1993

The regression results reported in Panel A of Table 1 show, as expected, that enrollment demand is elastic with respect to the rate of unemployment (0.18) and the Vietnam military expansion (0.19). The coefficients are similar in magnitude to those reported by Lehr and Newton (1978) and suggest that rising unemployment reduces the opportunity cost of college and that the deferment motive can be a significant factor in college enrollments.

Empirical evidence of the character of competition in this environment is reported in equations 1b and 1c of Panel A. Equation 1b in particular shows that there is no competitive threat from the public sector in this environment. The cross-elasticity coefficient between enrollments at this institution and the average tuition price of the public universities is of the wrong sign and insignificantly different from zero.\(^8\) This result is consistent with the low cross-elasticity reported by McPherson (1978) for private comprehensive institutions and by Knudsen and Serville (1978) for a cross-section of private liberal arts or teachers colleges.

The finding that there is little effective competition for students between this private institution and either of the public institutions is consistent with the large differences in tuition that exist between the private and public higher education institutions. The average difference grew from US$3435 in 1983 to US$5705 in 1993, in 1982 dollars.

As McPherson (1978, pp. 187–190) noted some time ago and recent empirical work by Moore et al (1991) and Parker and Summers (1993) confirm, the ability to withstand competition from alternative institutions can depend on real qualitative differences between higher education institutions. Likely differences at work here pertain to institutional size, institutional identity and reputation, admissions selectivity, student mentoring by faculty, and the part of the family income distribution from which the student populations are drawn.

A significant substitute relationship does exist between this institution and an established, private, comprehensive universities in the region. The cross-elasticity coefficient of 0.51 (equation 1c) is statistically significant and of the right sign for a substitute good.\(^9\) Further, as a comparison of equations 1a and 1c of Panel A shows, the presence of the competitor’s tuition price causes the absolute value of the own price elasticity to increase from 0.64 to 1.09, corroborating the substitute nature of the relationship (Walters, 1970, pp. 213–217).\(^10\)

We also find a prominent role for income variation in our empirical results. The income elasticity coefficient is 1.5, confirming that private education is a normal good.

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\(^7\) Other functional forms, such as a simple linear specification, were examined in preliminary work. The best results were obtained with the log-log specification.

\(^8\) The cross-elasticity estimates (t-ratios) between enrollments in this private institution and each of the public higher education tuition prices considered separately are \(-0.88(−0.70)\) for the public comprehensive university and \(0.032(0.27)\) for the public research, doctoral granting university.

\(^9\) To conserve on degrees of freedom, the variable for public institution prices is removed from further regressions.

\(^10\) There is little in the literature with which to compare this result. The aggregate demand studies have focused on the impact of public tuition prices on private-sector enrollments. And the cross-elasticities between private institutions reported by Knudsen and Serville (1978) are of the wrong sign and not significantly different from zero, perhaps due to collinearity problems. However, the study by Vaughan and Baxter (1988) found similar gross price (\(-1.10)\) and cross (0.85) elasticities for a public four-year college in Utah with a state university competitor.
Table 1
Regression analysis of enrollment demand for a private comprehensive university

<table>
<thead>
<tr>
<th>Equ.</th>
<th>ln $P$</th>
<th>ln $P_{Net}$</th>
<th>ln $I$</th>
<th>ln $U$</th>
<th>ln $P_c$</th>
<th>Public ln $P_c$</th>
<th>DUM</th>
<th>ln SCH</th>
<th>$R^2$</th>
<th>DW</th>
<th>N</th>
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<tbody>
<tr>
<td>Panel A: 1959–1993</td>
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<tr>
<td>1a.</td>
<td>$-0.636$</td>
<td>1.796</td>
<td>0.186</td>
<td></td>
<td></td>
<td>0.157</td>
<td></td>
<td></td>
<td>0.88</td>
<td>1.23</td>
<td>35</td>
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<td></td>
<td>(2.05)*</td>
<td>(3.67)**</td>
<td>(3.99)**</td>
<td></td>
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<td>(3.68)**</td>
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<tr>
<td>1b.</td>
<td>$-1.082$</td>
<td>1.500</td>
<td>0.184</td>
<td>0.531</td>
<td></td>
<td>$0.016$</td>
<td>$0.194$</td>
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<td></td>
<td>(3.08)**</td>
<td>(3.07)**</td>
<td>(3.07)**</td>
<td>$-0.15$</td>
<td>(4.21)**</td>
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<tr>
<td>1c.</td>
<td>$-1.086$</td>
<td>1.534</td>
<td>0.188</td>
<td>0.511</td>
<td>$0.189$</td>
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<td></td>
<td>(3.50)**</td>
<td>(3.49)**</td>
<td>(3.06)**</td>
<td>(4.85)**</td>
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<tr>
<td>Panel B: 1975–1993</td>
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<tr>
<td>2a.</td>
<td>$-1.054$</td>
<td>1.756</td>
<td>0.085</td>
<td>0.605</td>
<td></td>
<td>0.091</td>
<td></td>
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<tr>
<td></td>
<td>(3.22)**</td>
<td>(4.02)**</td>
<td>(1.63)</td>
<td>(2.57)*</td>
<td></td>
<td>(2.20)*</td>
<td></td>
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</tr>
<tr>
<td>2b.</td>
<td>$-1.530$</td>
<td>0.636</td>
<td>0.113</td>
<td>0.605</td>
<td>$0.904$</td>
<td></td>
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<tr>
<td></td>
<td>(3.22)**</td>
<td>(1.63)</td>
<td>(2.23)*</td>
<td>(2.57)*</td>
<td>(2.29)*</td>
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$()$ = t-statistic; **significant at 1 percent level; *significant at 5 percent level.

Note: Public ln $P_c$ is the tuition price of the public higher education alternative. It is the average price of the two public institutions weighted by enrollments. Private ln $P_c$ is the tuition price of the private higher education institution. DUM is the dummy variable and corresponds to $D_1$ in Panel A regression results and $D_2$ in Panel B regression results. $D_2$ was not significant in the regressions for the period 1959–1993.

Our income elasticity estimate is similar in magnitude to the 1.66 reported by Knudsen and Serville (1978) for private institutions with private competitors and somewhat larger than the 1.10 reported by Hight (1975) for aggregate private enrollments. These private-sector income elasticity coefficients are considerably larger than the 0.30–0.70 elasticity coefficients reported for public-sector enrollments. Thus the near doubling of real per capita income from 1959 to 1993 favored significant enrollment growth at this, and other, private institutions.

3.2. Results for period 1975–1993

Recent studies by Ehrenberg and Sherman (1984) Moore et al (1991), and Wetzel, O'Toole and Peterson (1998) provide evidence that enrollment decisions are sensitive to the availability of scholarships and grants as well as to tuition costs. They find no empirical evidence that enrollments are sensitive to other forms of financial aid such as loans.12

We explore the role of net, or discounted, tuition price (gross tuition price minus scholarships and grants) for this institution in Panel B of Table 1 for the period for which data on scholarships and grants are available.

For purposes of comparison with the larger sample period, regression results for the basic model employing gross tuition price are presented in equation 2a, Panel B of Table 1. These results are virtually identical to those reported in equation 1c of Panel A. They show that enrollment demand is unit elastic with respect to gross tuition price and positively influenced by income vari-

11 A price inelastic coefficient ($-0.64$) is shown in equation 1a of Panel A of Table 1. However, as noted in the text, this estimate is biased downward due to the absence of control for substitute goods.

12 Sample size and high collinearity among financial aid variables rule out employing alternative measures of financial aid as regressors in this study.
ation, the tuition price of the competitor institution and high levels of unemployment.\textsuperscript{13}

Equation 2b reports the results for the net price equation.\textsuperscript{14} Except for the role of income, the impact of the non-price variables in the net price equation is similar to those obtained with gross tuition price equations. However, we lose the influence of income in the net price equation. Our income elasticity coefficient is a positive 0.64, but it is not different from zero by the usual statistical tests. A similar result is reported in other studies employing net price equations. Ehrenberg and Sherman (1984), for example, find a positive, but insignificant, income coefficient for Cornell and Moore et al (1991) report an insignificant, though negative, income coefficient in their net price equation for Occidental College.

The elasticity of enrollments to net, or discounted, tuition price is $\approx 1.53$. This coefficient is statistically significantly above unity, indicating a high degree of student sensitivity to tuition costs net of scholarships and grants. This is perhaps the strongest evidence reported to date that tuition discounts do matter in the competition among institutions.

For this institution, the implication is that one can strongly adversely impact institutional income by raising the tuition price without an accompanying increase in scholarships and grants. Conversely, a vigorous development program to increase scholarship grants has the potential to positively impact student enrollments and raise institutional income significantly.

4. Conclusions

This study examines the regional market environment facing a private, comprehensive institution of higher education. Our methodology allows for the estimation of demand elasticities in a clear and unambiguous manner. Our findings are consistent with much that is generally known about the characteristics of enrollment demand in higher education. Enrollments are significantly negatively related to either gross or net tuition prices, private education is a normal good and there is an empirically significant enrollment response to the opportunity cost of college enrollment.

These propositions pertain to the signs of the estimated coefficients and merit considerable confidence. They are robust across different methodologies, different specifications of variables and different levels of data aggregation, as the empirical literature shows.

This paper offers new evidence of the character of competition among higher education institutions. We find no evidence that tuition policies at public institutions will adversely impact enrollments at this private institution. Our estimated cross-price elasticity for public competitors is insignificant and of the wrong sign for substitute goods. As far as we know, there are no other published studies specific to an institution with which to compare this result. Similarly insignificant cross-price elasticities have, however, been reported by Knudsen and Serville (1978) for a national cross-section sample of moderately selective private institutions.

We do find a significant substitution relationship between this institution and another private, comprehensive institution within the region. The evidence is twofold: first, there is a positive, empirically significant, cross-price elasticity coefficient; and second, the presence of the competitor’s tuition prices causes the own price elasticity coefficient to increase, in absolute value, from 0.64 to 1.09. Thus, we conclude that competition among private institutions limits the revenue-generating ability of gross tuition price increases at this institution.

Competition for students has led to significant tuition discounts in the form of scholarship grants at this institution. The average tuition discount now approaches 40 percent of gross tuition and fees. The empirical impact of scholarship grants is reflected in our estimated net price elasticity of $\approx 1.53$. Clearly, gross tuition price increases, unaccompanied by greater scholarship awards, significantly adversely impact enrollments at this institution. This result points to significant pressures for this private institution to provide financial aid in the form of scholarship grants.

These results may not be transferable across institutional types and/or geographical areas. The finding of a net price elasticity well above unity contrasts with net tuition price elasticities of $\approx 1.09$ reported for a private, research, doctoral-granting university in upstate New York and $\approx 0.72$ reported for a private liberal arts college located in Southern California. The latter net tuition price elasticities do not suggest strong substitute relationships.\textsuperscript{15}

As previously noted, institutionally based studies are few in number. There is a real need for further research focused on specific universities and colleges before we can usefully generalize about the magnitude of the econ-

\textsuperscript{13} The pronounced recession of 1981–83 plays a significant role in the 1975–1993 regressions. However, in general, the influence of unemployment on enrollments, as captured by the $\ln U$, does appear to have weakened during this period.

\textsuperscript{14} Our specification implies that a dollar of aid is equivalent to a dollar of tuition. Sample size and high correlations among the grants variable and other regressors such as income ($r = 0.91$) and the tuition price of the private competitor ($r = 0.97$) prevent the identification of separate impacts for tuition and grants.

\textsuperscript{15} These studies employ dependent variables that are specified in percentage terms. Their implied elasticities involve the calculation of the percent change of a percent in the numerator. This may bias their results downward.
omic forces bearing on the character of competition among higher education institutions.

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References


