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Tuition Revenues and Enrollment Demand: The Case of Southern Utah University

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Abstract

This paper details our experience with successfully increasing tuition revenues at Southern Utah University and provides a case study in how economic research and the politics of tuition policy combined to increase university revenue with stakeholder buy-in. Our success was based on three key factors: (a) we had a key administrator who advocated economic modeling and a positive basis for tuition policy; (b) we obtained empirical evidence of the effects of the proposed tuition increase by estimating an enrollment demand model; and (c) we were able to obtain stakeholder buy-in. Following the largest tuition increase in over 30 years, enrollment growth has remained strong and revenues have increased.

Keywords: tuition elasticity, enrollment demand.

Introduction

In recent years, the public higher education industry has experienced a profound transformation away from state support coinciding with escalating costs of delivering quality education. Institutions are forced to develop niche strategies to differentiate their products and compete in a monopolistically competitive market. At most institutions, this marketing strategy includes high-cost services and facilities such as state-of-the-art residence halls, expansive food services, technologically advanced computing infrastructure, diverse entertainment opportunities, and robust curriculum. Institutions also face pressure to invest in continuous

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academic improvement by recruiting quality faculty and staff, seeking specialized accreditations to garner third party validation, and expanding academic support.

Declining state support and escalating costs have increased dependency on tuition as a revenue source. National Center for Education Statistics data (2007) indicate that from 1981 to 2001 tuition's share of total public institution revenues increased from 12.9% to 18.1%, while state appropriations declined from 44.0% to 31.9%. Greater dependency on tuition has motivated many administrators to develop formal strategies to gain support for higher rates of tuition increase. What is a successful strategy to win this kind of support? This paper details our experience with successfully increasing tuition revenues at Southern Utah University (SUU) and provides a case study in how economic research and the politics of tuition policy combined to increase university revenue with stakeholder buy-in.

SUU is located in the rural, southwestern corner of Utah and has approximately 7,000 students. Started in 1897 as a public teacher training school, it has steadily evolved into its current role as a Carnegie Basic Classification: Master's Small.[1] It serves the entire southern region of Utah and contiguous counties of two states with undergraduate and graduate programs. Partly as a result of an increasing Utah population, SUU has generally experienced healthy enrollment growth averaging about 4.7% annually since 1980.

Table 1 presents a comparison of the nine institutions in the Utah System of Higher Education (USHE) for 2002–03, the time of this study. At that time, the USHE consisted of two Doctoral universities (University of Utah and Utah State University), one Master's Medium university (Weber State University), one Master's Small university (SUU), two Baccalaureate/Associate's colleges (Utah Valley State College and Dixie State College), and three Associate's colleges (Salt Lake Community

Table 1

Utah System of Higher Education Statistical Comparison, 2002–03

	Annualized FTE Enrollment			Annual UG Tuition & Fees		
Institution	**Under-graduate**	**Graduate**	**Total**	**Tuition**	**Fees**	**Total Cost**
University of Utah	19,736	6,442	26,178	$2,742	$583	$3,325
Utah State University	15,232	2,352	17,583	$2,324	$510	$2,834
Weber State University	13,655	311	13,965	$1,947	$480	$2,427
Southern Utah University	4,999	220	5,219	$1,888	$462	$2,350
Utah Valley State College	16,890	0	16,890	$1,842	$354	$2,196
Dixie State College	4,251	0	4,251	$1,320	$292	$1,612
S.L. Community College	16,223	0	16,223	$1,564	$326	$1,890
Snow College	2,694	0	2,694	$1,253	$270	$1,523
College of Eastern Utah	2,058	0	2,058	$1,296	$334	$1,630

Notes: Undergraduate enrollment data includes vocational students; graduate enrollment data includes medical students at the University of Utah. Tuition and fee figures are for full-time (15 credit hours) undergraduate state residents, for two semesters.

Source: *Utah System of Higher Education 2003–2004 Data Book.*

[1] The Carnegie Basic Classification states: "Master's program size was based on the number of master's degrees awarded in 2003–04. Those awarding at least 200 degrees were included among larger programs; those awarding 100–199 were included among medium programs; and those awarding 50–99 were included among smaller programs." Retrieved from http://www.carnegiefoundation.org/classifications/index.asp?key=798

College, Snow College, and College of Eastern Utah). With about 5% of the state's total higher-education FTE enrollment, SUU is among the smaller institutions in the state. Nevertheless, based on county-level enrollment data, student transfer patterns, and anecdotal evidence, it appears that SUU competes, to some extent, with all state schools for undergraduate students.[2]

For the 2002–03 academic year, undergraduate tuition and fees at SUU were about 4% below the state average for all Bachelor's-degree-granting institutions (Table 1). Moreover, SUU has had relatively low tuition historically. Table 2 compares SUU in-state tuition and fees to other public four-year averages for Utah and nationally since 1977.[3] On average over the time period considered, SUU tuition has been approximately 83% of other Utah four-year public institutions and approximately two-thirds of the U.S. average. Indeed, in 2004, *Consumers Digest* rated SUU one of the nation's "top 10" best bargains in higher education.

In early 2002, certain administrators perceived the institution's "low-cost provider" marketing strategy was no longer viable in the face of declining state support, increased competition from some Utah colleges, and institutional goals to improve quality and build programs.[4] Moreover, SUU had experienced negative rates of growth in freshman enrollments in three of the last four years, an unprecedented occurrence looking back at least 25 years. The university had to generate more revenue to fulfill its mission and compete in a changing environment, and the legislature was not forthcoming. In response, the university's administration advocated a two-part strategy to

Table 2

Historical Tuition and Fees: SUU, Other Utah Four-Year Institutions, and U.S. Public Four-Year Institutions

		Public Averages		Ratio of SUU to	
Year	SUU	Other Utah	U.S.	Other Utah	U.S.
1977	$504	$556	$617	0.91	0.82
1978	$534	$600	$655	0.89	0.82
1979	$564	$638	$688	0.88	0.82
1980	$606	$707	$738	0.86	0.82
1981	$606	$789	$804	0.77	0.75
1982	$735	$851	$909	0.86	0.81
1983	$735	$926	$1,031	0.79	0.71
1984	$852	$1,015	$1,148	0.84	0.74
1985	$852	$1,099	$1,228	0.78	0.69
1986	$969	$1,248	$1,318	0.78	0.74
1987	$1,071	$1,310	$1,414	0.82	0.76
1988	$1,167	$1,408	$1,537	0.83	0.76
1989	$1,245	$1,526	$1,646	0.82	0.76
1990	$1,350	$1,627	$1,780	0.83	0.76
1991	$1,419	$1,709	$1,888	0.83	0.75
1992	$1,497	$1,808	$2,117	0.83	0.71
1993	$1,599	$1,943	$2,349	0.82	0.68
1994	$1,698	$2,049	$2,537	0.83	0.67
1995	$1,779	$2,118	$2,681	0.84	0.66
1996	$1,800	$2,155	$2,848	0.84	0.63
1997	$1,854	$2,237	$2,987	0.83	0.62
1998	$1,909	$2,314	$3,110	0.82	0.61
1999	$1,965	$2,382	$3,229	0.82	0.61
2000	$2,066	$2,468	$3,349	0.84	0.62
2001	$2,194	$2,628	$3,501	0.83	0.63
2002	$2,350	$2,872	$3,735	0.82	0.63
2003	$2,794	$3,116	$4,046	0.90	0.69

Notes: Utah data excludes Utah Valley State College and Dixie State College which had minimal upper division enrollments for most of the time period.

Source: *Southern Utah University Factbook 2005–2006;* National Center for Education Statistics, *Digest of Education Statistics 2004* (Washington, DC: U.S. Department of Education), Table 413.

[2] While SUU has a few Master's programs, most were small and relatively new at the time of this study and therefore were not considered serious competitors to the better established graduate programs in the state.

[3] It should be noted that, for purposes of making the Utah data consistent with the available national data, Table 2 compares SUU to other four-year institutions within the state while the "price" variable described later makes a similar but distinct comparison relating SUU's tuition and fees to all institutions of higher education in Utah.

[4] A proponent of this position was SUU's Provost at the time, Abe Harraf, one of the authors of this paper.

gain support for a substantial tuition increase: (a) conduct quantitative analysis to estimate the net impact of tuition increases on revenues and growth; and (b) educate stakeholders and provide a normative basis for tuition increases through a series of meetings and other public forums. The following describes each part of this process.

The Positive Component: Enrollment Demand

The key to quantitative analysis of the impact of tuition changes is the tuition elasticity of enrollment demand, a measure of how responsive enrollment is to changes in tuition.[5] More specifically, the tuition elasticity indicates the percentage change in enrollment that would result from, or be associated with, a given percentage change in tuition. Holding everything else constant, enrollment and tuition are expected to move in opposite directions (i.e., enrollment is expected to go down when tuition is increased if all other factors are controlled). If the percentage decline in enrollment is less than the percentage increase in tuition, then the absolute value of the elasticity measure is less than one, and enrollment demand is said to be *inelastic,* implying total tuition revenue will increase since the gain from higher tuition is not offset by the decline in enrollment. On the other hand, if the percentage decline in enrollment is greater than the percentage increase in tuition, the absolute value of the elasticity measure is greater than one and demand is said to be *elastic,* implying total tuition revenue will decrease with an increase in tuition since the losses from lower enrollment will surpass the gains from higher tuition.[6] Thus, the magnitude of the elasticity measure is essential for determining the economic impact of a tuition increase.

In this case, it is assumed that enrollment represents the demand for an SUU education, and tuition and fees reflect the price of an SUU education. Since SUU is essentially an open-enrollment institution, admitting nearly every student that applies, enrollment is a good measure of demand. This section outlines the development of the demand model used to estimate the tuition elasticity and provides a positive basis for SUU's tuition increases.

Literature Review

Gallet (2007) performed a meta-analysis of 295 demand elasticity estimates from 60 studies for higher education. Of these, only 65 estimated institution-level elasticities, while the bulk were based on data aggregated across multiple institutions at the region, state, or national level. However, estimates based on institution-level data were not consistently different from those based on aggregated data. As might be expected, estimates were generally more elastic the longer the time period considered (the impact of a tuition change is larger when viewed over multiple years because students have more time to adjust). Importantly, Gallet found that elasticity estimates were sensitive to how enrollment numbers and tuition were

[5] This is closely associated with what economists call the *own-price elasticity of demand,* defined as the percentage change in the demand for some good or service divided by the percentage change in the price of that good or service. Formally, own-price elasticity is given as

$$E_{Q_x,P_x} = \frac{\partial Q_x}{\partial P_x}\frac{P_x}{Q_x},$$

where Q_x represents the quantity demanded of *x* and P_x represents the price of *x*. For more information on the elasticity concept, see Baye (2006, Ch. 3) or Mankiw (2007, Ch. 5).

[6] In theory, it is possible that an increase in tuition can result in an increase in enrollment, implying the own-price elasticity is positive. Economists Robert Giffen and Thorstein Veblen each described distinct conditions where an increase in price might result in an increase in demand, resulting in what are termed "Giffen goods" and "Veblen goods" respectively. Empirical evidence of Giffen or Veblen goods is very rare however.

measured; for example, using freshman enrollment generally resulted in larger elasticity estimates than total enrollment (new students are more sensitive to cost than continuing students). Moreover, the magnitude of elasticity estimates tended to be sensitive to model specification and the estimation method used. Generally, non-linear functional forms that use logarithms of variables (e.g., the log-log model) resulted in lower elasticity estimates than linear models. The use of more technical estimation methods such as Generalized Least Squares (GLS) or Two-Stage Least Squares (2SLS) also tended to produce lower elasticity estimates.[7]

Gallet found considerable variation in elasticity estimates (averaging -0.6 with a standard deviation of 1.0). Other studies have also found considerable variances in price elasticity among demographically different institutions and urged additional institution-specific research (Heller, 1997; Leslie & Brinkman, 1987; Wetzel, O'Toole, & Peterson, 1998).

Demand studies using aggregated data have generally found the tuition effect to be inelastic and other factors to be more important in explaining enrollment (Becker, 1990; Campbell & Siegel, 1967; Hearn & Longanecker, 1985; Heller, 1999; Leslie & Brinkman, 1987; McPherson & Shapiro, 1991; Wetzel et al., 1998).[8] This result is consistent with economic theory since models at a high level of aggregation cannot fully capture the effects of students switching between institutions. Fredriksson (1999) found the major determinant was after-tax wages accruing to college graduates. Using institution-level data, Mueller and Rockerbie (2004) found the academic reputation of the institution was a stronger demand determinant than either tuition or family income; Buss, Parker, and Rivenburg (2003) also found academic reputation to be significant at selective liberal arts colleges. Abraham and Clark (2006) found that a tuition assistance grant program significantly increased both applications and enrollments by District of Columbia students of all ability levels.

Why is the demand for higher education often found to be inelastic? Heller (1999) argues that the fairly recent, yet substantial, increase in the earnings of college graduates relative to non-college graduates helps explain tuition-rate insensitivity. Leslie and Brinkman (1987) postulate several reasons why the demand for a college education might be inelastic: relatively small tuition increases historically, after adjusting for inflation; the ability of students to move to lower-cost institutions and use financial aid to reduce the effects of tuition increases; an increasing consumer base resulting from the expanding participation of women, non-traditional students, and less-prepared students; and institutions engaging in aggressive marketing.

Empirical Model

The following relationship indicates the starting point for the analysis:

$$enrollment_t = f\,(tuition_t, relatedprices_t, enrollment_{t-1}, graduates_t, unemployment_t, income_t),$$

where $enrollment_t$ is the level of enrollment for year *t; tuition*$_t$ denotes the cost of tuition and fees in year *t; relatedprices*$_t$ represents prices of related goods in year *t; graduates*$_t$ is the number of high-

[7] Generalized Least Squares (GLS) is an estimation procedure often used when the regression error term is not well behaved; for example, when the error term exhibits heteroskedasticity (non-constant variance) or serial correlation (correlation with itself over time). Two Stage Least Squares (2SLS) is an estimation procedure used when an explanatory variable is correlated with the error term, typically because an important explanatory variable has been omitted or because an included explanatory variable is determined simultaneously with the dependent variable. The appropriateness of these methods can only be judged in context. While these estimation techniques are more complicated than the commonly used method of ordinary least squares (OLS), the resulting equations are interpreted in the usual way.

[8] In this context, disaggregated data are at the institution level while aggregated data combine institutions together at the state, regional, or national level.

school graduates available for college enrollment in year *t; unemployment*$_t$ is a measure of the level of unemployment in year *t;* and *income*$_t$ is the level of per capita income in year *t*. While the initial model specification is fairly standard in terms of both economic theory and previous work on university enrollment demand, many of the details involving data and model development are distinguishing. Specifics follow.

To focus the analysis, the dependent variable was defined as annual, in-state freshman enrollment at SUU. Because prior studies have generally found freshmen students to be the most sensitive to tuition changes, the effects of interest should be most clearly identifiable for this group. Non-resident students were not considered because they are relatively few in number at SUU and because their behavior is believed to be impacted by a broader set of factors.

The effective tuition level was taken to be the sum of annual (two semesters) tuition and fees per full-time, resident student expressed in real terms (i.e., adjusted for inflation using the CPI), which can be interpreted as a representation of the "price" of enrollment. Although the full cost, or price, of an SUU education includes a number of other elements, the focus of this study is on the effect of changes in tuition. Moreover, this variable is a reasonable proxy for the total direct cost of attending college since it captures a large portion and reflects most of the year-to-year variation.

Related prices were initially modeled with comparable tuition and fee rates at all other public colleges and universities within the state. However, because of the way tuition is determined in the state's system of higher education, there is a high degree of collinearity across tuition levels; thus, including variables representing prices at other state schools is not feasible because they move together so closely that the effects cannot be disentangled statistically.[9]

Because of the collinearity problem, an alternative own-price variable (i.e., the variable representing the effect of the institution's own tuition level on its enrollment) was subsequently defined as the ratio of SUU's annual tuition and fee rate to the state average, and tuition and fee rates at other state colleges and universities were dropped from the model.[10] This specification allows the own-price variable to capture competitive effects to some degree, since SUU tuition is measured relative to in-state competitors, and resolves the collinearity problem since the effects of tuition changes at competitor schools are not estimated individually. The own-price effect is expected to be inversely related to enrollment after controlling for all other factors in the model.

The inclusion of a lagged dependent variable implies that the size of the previous year's freshman class impacts, or is associated with, enrollment in the current year.[11] If a particular cohort of freshmen students have a good experience at SUU, they

[9] The state's Board of Regents sets a base rate for tuition increases for all schools in the system annually. While individual institutions have some flexibility to increase tuition above the base rate, they often choose to stay close to the mandated base-rate increase.

[10] State junior colleges were included in the tuition and fee average because they also compete for freshmen students. Note that the data in Table 2 are based on four-year institutions only, while the *tuition* variable is based on all state institutions of higher education.

[11] Lagged dependent variables are common in economic and econometric modeling (see, for example, Kennedy, 2003, pp. 163–166 and Wooldridge, 2006, pp. 400–402). The estimated model showed no evidence of serial correlation based on Durbin's test for serial correlation when there is a lagged dependent variable. The absence of serial correlation in a time-series regression with a lagged dependent variable suggests the model is "dynamically complete," meaning further lags of the independent and dependent variables are not important for explaining enrollment (Wooldridge, 2006, pp. 400–402). Nevertheless, for thoroughness, alternative finite distributed lag models were considered, lagging the independent variables up to three years, but in all cases additional lagged variables were neither individually nor jointly significant.

are likely to spread the word among their friends and relatives which will have a positive feedback effect on enrollment in the next year and beyond. Similarly, growth may signal status or popularity and spur more growth. Thus, changes in enrollment are expected to drive further changes. The lagged dependent variable can also capture the effects of shocks that persist over time, such as an event that generates unusual publicity.

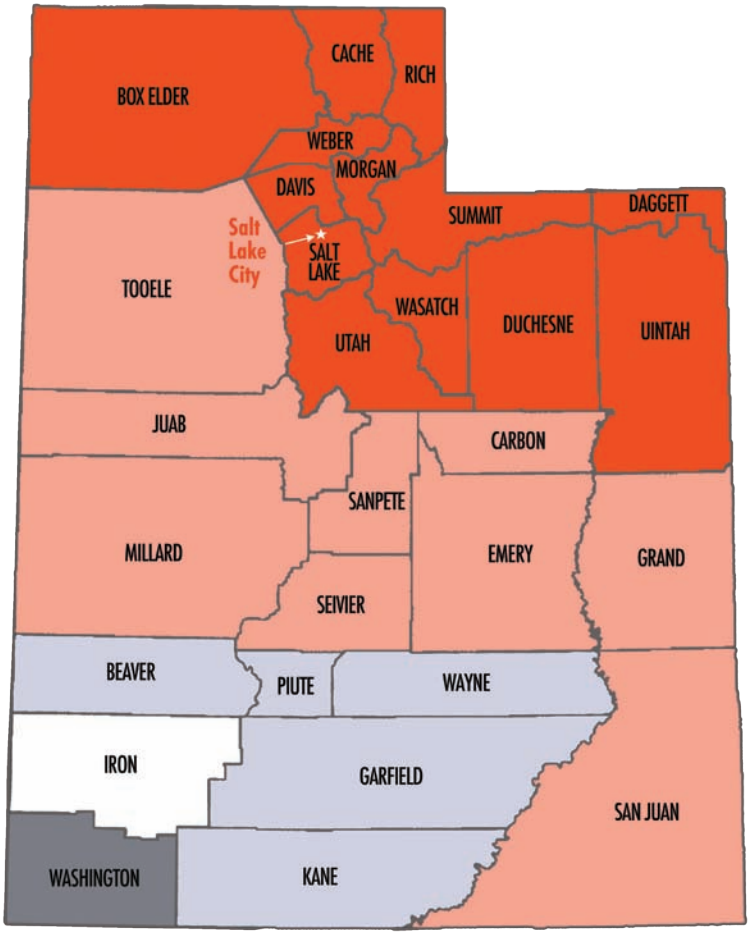

Figure 1. Utah counties and regions defined for analysis.

The number of high school graduates was included to capture market size. Clearly, this variable should have a strong positive effect on enrollment. The opportunity cost of obtaining a college education is primarily foregone earnings from a full-time job. Following earlier studies (Chressanthis, 1986; Heller, 1999), the unemployment rate was used as a proxy for opportunity cost with an expected positive sign. Per capita personal income represents income effects although the direction of its impact is ambiguous *a priori*, since generally higher income might increase SUU enrollment by making it more affordable (i.e., an SUU education is a "normal" good) or reduce SUU enrollment because students can now afford a more expensive school than SUU (i.e., an SUU education is an "inferior" good[12]).

The model was estimated using county-level panel data with county dummy variables to control for regional differences (e.g., distance from the university, tastes and preferences, and the geographic proximity of substitutes); see Figure 1. Finally, because some of the variables are trending, a linear time-trend variable was included in the empirical analysis to control for the possibility of spurious time-wise relationships.[13]

Empirical Results

Panel data were available for all 29 Utah counties for the 1979 through 2002 time period.[14]

[12] When the demand for a good decreases with increases in income, the good is called inferior by economists; in contrast, normal goods are those for which demand increases with increases in income.

[13] Frequently, two time-series variables can appear to be more closely related than they actually are simply because both trend over time for extraneous reasons; thus, time-trend variables are often included in econometric analyses to control for these kinds of spurious relationships (Wooldridge, 2006, pp. 363–369). Other types of trend relationships were considered but were rejected empirically.

[14] Enrollment data were obtained from SUU's provost office. County unemployment rates were collected from the Utah State Governor's Office of Planning and Budget. Per capita personal income figures came from the Bureau of Economic Analysis. High school graduates data were tabulated using information from the Utah State Office of Education. Undergraduate tuition and fees for each of the higher education institutions in Utah were collected from the Utah State Board of Regents. The Consumer Price Index (CPI), used to deflate dollar-denominated variables, was obtained from the Bureau of Labor Statistics.

Table 3

County-Based Districts

District	Counties Included
IRON	Iron County
BEAVER	Beaver County
KANE	Kane County
SEVIER	Sevier County
UTAH	Utah County
WASHINGTON	Washington County
SALTLAKE	Salt Lake and Summit Counties
GARFIELD	Garfield, Wayne, and Piute Counties
MILLARD	Millard, Juab, Tooele, and Sanpete Counties
NORTHWEST	Box Elder, Cache, and Rich Counties
DAVIS	Davis, Weber, and Morgan Counties
NORTHEAST	Duchesne, Uintah, Wasatch, and Daggett Counties
CENTRAL	Emery, San Juan, Carbon, and Grand Counties

Because of data limitations, and based partly on theoretical considerations, Utah's 29 counties were aggregated into the 13 county-based districts or individual counties described in Table 3 (generally, the more important counties, based on enrollment numbers, were left separate). The final data set thus consisted of 299 observations: 23 time periods, after losing one year because of the lagged variable, and 13 cross sections.

Names and descriptive statistics for each of the quantitative variables, in levels, are given in Table 4. Based primarily on experimentation and functional-form tests, the final version of the empirical model was specified with the dependent variable, ENROLL, and the independent variables GRADS and PCINC in natural log form. The TUITION and UNEMP variables, both percentages, were not entered in log form.[15] (Note that while the linear trend variable was specified in level form, the logged dependent variable means enrollment follows an exponential trend, implying a constant average growth rate.)

In addition to the district-level aggregation described above, larger regions were created by aggregating districts to facilitate testing for differences in slope coefficients across key geographic areas (Figure 1). Analysis of differences across the 13 districts was assumed to be too detailed given study goals and data available. After singling out two particularly important counties as

Table 4

Descriptive Statistics for Quantitative Variables

Variable	Name	Mean	St. Dev.	Min.	Max.
Freshman Enrollment	ENROLL	53.0	53.8	5	240
SUU Tuition and Fees	TUITION	102.9%	5.9%	91.2%	110.0%
High School Graduates	GRADS	1,923	2,755	49	12,428
Unemployment Rate	UNEMP	6.2%	2.5%	2.6%	17.6%
Per Capita Personal Income	PCINC	10,272	1,532	7,817	16,387

Notes: Variables are in level form; statistics are based on 299 observations, across all time periods and cross sections; PCINC is deflated by the CPI, 1982–84 = 100; average SUU tuition & fees over the time period were $1,405 (nominal).

[15] This functional form implies the following interpretation for the coefficient associated with the TUITION variable (βT): a one-percentage-point increase in TUITION results in, approximately, a 100βT percent increase in ENROLL (see Studenmund, 2006, Ch. 7 for a good discussion on choosing and interpreting functional forms in regression analysis). While this is not precisely the same as the own-price elasticity previously defined, it is very similar.

Table 5

Utah Regions

Region1	Northern Region: Utah, Salt Lake, Northwest, Davis, and Northeast Districts
Region2	Central Region: Sevier, Millard, and Central Districts
Region3	Southern Region: Beaver, Kane, and Garfield Districts
Region4	Iron County
Region5	Washington County

independent regions—Iron, the county in which SUU is located, and Washington, a neighboring county with a relatively large population—the remaining part of the state was divided into three broad, geographic regions: Northern, Central, and Southern, as shown in Table 5. Dummy variables representing each of the five resulting regions were defined to use in testing various interaction terms.

The initial model specification allowed for different slope coefficients across the five regions for each of the quantitative variables. However, in an effort to improve parsimony, models with slope coefficients restricted across regions were also considered (i.e., models with common slope coefficients across regions were compared against the unrestricted model allowing for unique slope coefficients across regions). With respect to the coefficients associated with the control variables, joint hypothesis tests indicated no significant differences across regions with one exception: the effect of the trend variable was found to be statistically significant for Region 1 but not statistically different from zero in the other regions. Thus, the results described below include a variable called TREND1, which is the time trend interacted with the Region 1 dummy variable, while the other regional trend variables were dropped from the model. That is, with respect to Region 1, enrollment exhibits an upward trend that cannot be explained by other factors in the model, but there is no such trend effect in the other regions.

Given that the hypothesized restrictions were not rejected, in the final regression, the variables L1ENROLL, GRADS, UNEMP, and PCINC were each assumed to have the same coefficients across regions. The coefficients associated with the five regional TUITION variables were estimated and reported separately because these effects are the focus of the study, and even minor regional differences may be of some interest. Table 6 summarized the final set of variables used in the model.

Results and Discussion

OLS regression results are presented in Table 7. Overall model fit is good, and diagnostic tests indicated an acceptable functional form and no evidence of serial correlation or heteroskedasticity.[16]

The key finding is that changes in relative tuition have had no measurable negative effects on freshman enrollments. The variables TUITION3, TUITION4, and TUITION5, corresponding to the regions near SUU, are individually and jointly insignificant, implying they have no effect on enrollment. (Moreover, this result was robust to all model specifications considered.) In Central and Northern Utah, increases in tuition rates are associated with *increases* in enrollment—the coefficients associated with TUITION1 and TUITION2 are positive and statistically significant at the 5% level.[17] Clearly, a positive price effect is contrary to expectations and the law of demand. The best

[16] Details of test results are available on request from the authors.

[17] To demonstrate, the results indicate that a one-percentage-point increase in SUU's tuition relative to the state average (e.g., a tuition increase from 103% to 104% of the state average) would be associated with a 1.9% increase in freshman enrollment in Region 1 and a 2.6% increase in freshman enrollment in Region 2. Starting from 2002, this translates into an increase of about 9 students over what would have been expected without any change in relative tuition; there would be essentially no impact in the other regions.

Table 6

Variable Definitions

Variable	Type	Definition
ENROLL	Quantitative	The natural log of total freshmen enrollment, by county.
TUITION1	Quantitative	[(SUU tuition & fees)/state average)]*100 for Region 1.
TUITION2	Quantitative	[(SUU tuition & fees)/state average)]*100 for Region 2.
TUITION3	Quantitative	[(SUU tuition & fees)/state average)]*100 for Region 3.
TUITION4	Quantitative	[(SUU tuition & fees)/state average)]*100 for Region 4.
TUITION5	Quantitative	[(SUU tuition & fees)/state average)]*100 for Region 5.
L1ENROLL	Quantitative	The natural log of freshman enrollment, by county, lagged one year.
TREND1	Quantitative	An interactive linear trend variable for Northern Utah.
GRADS	Quantitative	The natural log of the number of current year high school graduates, by county.
UNEMP	Quantitative	County unemployment rate, expressed as a percentage.
PCINC	Quantitative	The natural log of real per capita county income.
BEAVER	Qualitative	A dummy variable indicating Beaver County.
KANE	Qualitative	A dummy variable indicating Kane County.
SEVIER	Qualitative	A dummy variable indicating Sevier County.
UTAH	Qualitative	A dummy variable indicating Utah County.
WASHINGTON	Qualitative	A dummy variable indicating Washington County.
SALTLAKE	Qualitative	A dummy variable indicating Salt Lake and Summit Counties.
GARFIELD	Qualitative	A dummy variable indicating Garfield, Wayne, and Piute Counties.
MILLARD	Qualitative	A dummy variable indicating Millard, Juab, Tooele, and Sanpete Counties.
NORTHWEST	Qualitative	A dummy variable indicating Box Elder, Cache, and Rich Counties.
DAVIS	Qualitative	A dummy variable indicating Davis, Weber, and Morgan Counties.
NORTHEAST	Qualitative	A dummy variable indicating Duchesne, Uintah, Wasatch, and Daggett Counties.
CENTRAL	Qualitative	A dummy variable indicating Emery, San Juan, Carbon, and Grand Counties.

explanation for this unusual result is changes in tuition may be correlated with an unobservable explanatory factor, such as changes in perceptions in Central and Northern Utah.[18]

The estimated coefficient associated with the lagged dependent variable (L1ENROLL) is statistically significant at the 10% level (p = .055) and implies that a 1% increase in freshman enrollment in a given year induces a .11% increase in freshman enrollment the following year, all else equal. It appears that, as postulated, increases in enrollment either drive further increases, to some extent, or the lagged dependent variable is capturing some of the unobservable dynamic effects of general improvements in popularity, awareness, or reputation. If the former explanation is correct, it implies freshman students are generally satisfied with their SUU experience.

The time-trend variable (TREND1) indicates that enrollment from Northern Utah, including the largest metropolitan areas of the state, has steadily increased about 3.5% per year above what would

[18] It is possible that increases in tuition might have a positive effect on perceptions of quality, especially in the regions where there is less familiarity with SUU, as has been observed in certain instances for some consumer goods (e.g., Rao & Monroe, 1989).

Table 7

OLS Regression Results

Dependent Variable: ENROLL

Independent Variable	Estimated Coefficient	Standard Error	*t*-statistic	*p*-value
Constant	5.334*	2.534	2.105	0.036
L1ENROLL	0.108**	0.056	1.926	0.055
TREND1	0.035*	0.008	4.223	0.000
GRADS	0.508*	0.140	3.624	0.000
UNEMP	0.002	0.008	0.289	0.773
PCINC	-0.351	0.286	-1.227	0.221
TUITION1	0.019*	0.008	2.326	0.021
TUITION2	0.026*	0.007	3.958	0.000
TUITION3	-0.003	0.007	-0.419	0.676
TUITION4	-0.004	0.011	-0.343	0.732
TUITION5	0.012	0.013	0.869	0.385
BEAVER	-1.264	1.182	-1.069	0.286
KANE	-1.444	1.181	-1.223	0.222
SEVIER	-4.692*	1.235	-3.800	0.000
UTAH	-5.197*	1.467	-3.541	0.000
WASHINGTON	-3.461*	1.489	-2.324	0.021
SALTLAKE	-4.769*	1.521	-3.130	0.002
GARFIELD	-1.325	1.190	-1.113	0.266
MILLARD	-4.791*	1.264	-3.790	0.000
NORTHWEST	-5.835*	1.444	-4.042	0.000
DAVIS	-5.607*	1.503	-3.732	0.000
NORTHEAST	-5.301*	1.398	-3.791	0.000
CENTRAL	-5.469*	1.270	-4.305	0.000

Number of observations = 299

R-squared = 0.90

Overall *F* statistic = 112.12; standard error of regression = 0.27.

* significant at the 5% significance level; ** significant at the 10% significance level

be expected by increases in high school graduates, an expanding enrollment base, and changes in the other explanatory variables. This effect was absent in other regions, suggesting the reputation or awareness of SUU in Northern Utah is improving beyond the direct influence of recent freshman enrollees. Moreover, if this trend continues, most of SUU's future growth will come from the Northern Utah region.

The regression results indicate for every 1% increase in high school graduates in a given Utah county, there is a .51% increase in SUU freshman enrollment from that county (GRADS);[19] this effect is statistically significant at the 1% level. This implies that while SUU has been growing steadily with increases in market size, it has not grown as fast as high school graduates and, thus, continually loses its share of potential students to other schools or endeavors.[20]

Neither unemployment (UNEMP) nor per capita personal income (PCINC) has a statistically significant effect on freshman enrollment. However, it is interesting to note that the estimated coefficient on per capita income is negative (p = .22), suggesting that SUU might be considered an inferior good by some college students.

Results associated with the district and county dummy variables are generally as expected.[21] In particular, after accounting for other factors, enrollment patterns for the rural counties close

[19] Because both the dependent variable and the independent variable in question appear in natural log form, the coefficient on the (logged) independent variable can be interpreted as the percentage change in the untransformed value of the dependent variable associated with a 1% change in the untransformed value of the independent variable. In this case, if the coefficient associated with the GRADS variable is less than one, and assuming the number of high school graduates is generally increasing over time, it implies the percentage of high school graduates enrolling at SUU is declining over time.

[20] In an alternative regression model that allowed for interaction terms between the GRADS variable and regional dummy variables, it was discovered that the effects of high school graduates is near zero in Iron County, where SUU is located. Thus, after controlling for other factors, changes in Iron County high school graduates have little impact on the number of SUU enrollments from Iron County. Since the county has been growing steadily, it appears that SUU is doing poorly in its immediate area.

[21] With a logged dependent variable, coefficients associated with dummy variables reflect the percentage difference between the indicated category and the base case. More specifically, if β_j is the coefficient associated with a dummy variable indicating the jth category, then $100\beta_j$ is the approximate percentage difference between the jth category and the benchmark (omitted) category.

to SUU (Beaver, Kane, Garfield, Wayne, and Piute Counties) are essentially the same as those of Iron County where SUU is located (Iron County is the excluded base variable).[22] Likewise, more distant counties generally have lower enrollment, all else being equal. Enrollment from Washington County, a neighbor expected to be part of SUU's immediate service area, is substantially below other Southern Utah counties (WASHINGTON). Washington County is unique because it is the most populous and highest income county in Southern Utah. It also has a popular two-year college which began offering selected baccalaureate degrees in 2001. The regression results are probably reflecting both the effects of different demographics as well as the impact of this new competitor.

The Normative Component: The Politics of Tuition Increases

Obviously, tuition increases can be quite unpopular for students, parents, and other stakeholders. Having statistical evidence that a tuition increase would likely have little effect on enrollment, while implying tacit acceptance by students, certainly does not satisfy all stakeholders or ensure the policy will be accepted and implemented. The political process is therefore critical.

SUU's administration was sensitive to the politics of tuition increases. In early fall 2002, the SUU administration met with student government leadership and asked them to prioritize the needs and improvements students were most concerned about. Students expressed a desire for more academic advisors, additional faculty, specialized accreditations, campus employment, and other services that would enhance their academic experience at SUU and increase persistence and degree completion. Based on input from academic deans and other stakeholders, the President's Council also compiled a list of priorities. Although the two lists were developed independently, there was a surprisingly high degree of overlap. Furthermore, regular student satisfaction surveys had consistently shown general agreement with the most critical priorities identified by student leadership and the President's Council. The areas of strong unanimity (e.g, more student jobs on campus, additional academic advisors and faculty) and the administration's promise to dedicate a substantial portion of the tuition increase to meeting these particular needs became an important selling point.

In late fall 2002, the Utah Board of Regents met with all higher education institutions in Utah to determine tuition rates for the upcoming year. SUU requested and was granted an increase of 23%, the highest increase of any institution in the state and the highest annual increase at SUU in over 30 years (tuition and fees went from 106.9% of the state average for all institutions in 2002 to 117.5% in 2003).

The Board of Regents granted the tuition increase for two primary reasons. First, SUU was the only institution to back up their tuition request with a formal analysis of the expected effects on enrollment and total revenue. Second, the administration provided evidence that they had worked closely with SUU stakeholders and had broad-based support for the tuition increase, especially from students. For instance, the SUU Student Government Association President attended the Regents' meeting and eloquently expressed strong support from students for the tuition hike, and described how student leadership had worked closely with the administration in outlining needs for additional funds. Perhaps the single most important influence on the Regents' decision was the willingness of the students to invest in their education and academic experience at SUU.

[22] A formal *F* test failed to reject the hypothesis that the respective coefficients are jointly equal to zero.

Upon receiving approval for the tuition increase, SUU immediately advertised four new academic advisor positions and three faculty positions. Likewise, a portion of the projected revenue increase was dedicated for additional student employment, and the process of identifying and describing the new student positions was started.

Subsequent enrollment data validated the predictions of the enrollment-demand model regarding tuition increases. Given actual values for each explanatory variable, the model predicted essentially no change in freshman enrollment for 2003. The actual change was a modest decrease of approximately 1.9% in terms of FTE and an increase of 7.8% in terms of headcount. In any case, tuition revenue increased substantially, and the actual change in enrollment was far from the large decrease some feared might result from the dramatic increase in tuition. Fall headcount freshman enrollment has continued to increase each year since 2003.

Summary and Conclusions

Our success with increasing tuition revenues at SUU was based on three key factors. First, a key administrator advocated economic modeling and a positive basis for tuition policy. He provided the internal initiative for making a significant change. Next, empirical evidence of the effects of the proposed tuition increase was obtained by estimating an enrollment-demand model. While nearly all estimates of higher education demand functions have found price inelasticity, having institution-specific evidence was critical in making the case to the Board of Regents. Finally, we were able to obtain stakeholder buy-in. Student and faculty support was generated through a participatory process of education and discussion. Remarkably, student leaders became enthusiastic supporters of the proposed tuition increase after participating in discussions regarding the justifications, objectives, and predicted impacts.

Following the largest tuition increase in over 30 years, enrollment growth has remained strong at SUU, and revenues have increased. The university has consequently expanded funding for vital needs including new faculty, advanced accreditation, increased computer lab space, academic advising, and student employment.

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