Section IV

Research Initiatives on Budget, Tuition, Fees, and State Funding

11   Researching the Different Effects of Tuition Policies That Impact Enrollment

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Many states have tuition reciprocity agreements that allow residents to attend college in another state without having to pay out-of-state tuition. In addition to providing residents with affordable access to education, states avoid costly duplication of programs and facilities, and universities can direct their resources to improving academic quality. Western Undergraduate Exchange (WUE), for example, allows students in western states to enroll in participating two-year and four-year public colleges at a reduced tuition level (i.e., up to 150% of the institution's regular resident tuition). In all cases, WUE tuition rates are considerably less than non-resident tuition rates (Western Interstate Commission for Higher Education, 2013).

For land-grant institutions with mandated statewide missions to enroll in-state students, tuition reciprocity can be a contentious topic for many reasons. Some view reciprocity as a way of subsidizing costs for out-of-state students. Many institutions cap the number of reduced tuition awards each semester and can be more selective when admitting reciprocity students, potentially decreasing diversity. Reciprocity students are less attractive economically for institutions since they often generate less revenue than full-pay out-of-state students. To improve our understanding of how reciprocity may influence enrollment and campus finances, this study estimates the impact of WUE students on institutional enrollment yield and net tuition revenues using data from a public four-year research university.

Literature Review

A number of studies over the years have explored the relationship between college costs and students' postsecondary education decisions. In their review of twenty-five studies on student responsiveness to tuition increases, Leslie and Brinkman (1987) predicted that a $100 change in tuition could result in an enrollment rate drop of about three-quarters of a percentage point for an 18–24-year-old. The authors conducted an additional forty-five analyses in their book, *The Economic Value of Higher Education,*

finding similar linkages between financial aid awards and participation in college. The authors concluded that 16% of all full-time students enrolled in college because of the existence of grants, and up to 40% of low-income students enrolled due to grant availability. Subsequent research focused on developing the econometric methods used to estimate student price response. Case studies in the 1990s consistently found significant inverse relationships between college costs and enrollment yield (Braunstein, McGrath & Pescatrice, 1999; Brooks, 1996; Heller, 1999; St. John, 1990; Trusheim & Gana, 1994). While there have been a number of studies on cohorts from the 1990s and early 2000s, the research on price response is less impressive for cohorts after the early 2000s. This study seeks to determine whether price response measures estimated prior to the early 2000s have changed with more recent cohorts that are experiencing historically high tuition rates. Higher education researchers (DesJardins, 1999; Heller, 1997) have long proposed that college-bound students may be more price sensitive as a result of sharp changes to tuition and aid policies.

With a number of tuition reciprocity agreements in place throughout the United States, little has been written on their impact on student access and campus finances. DesJardins's (1999) study simulated the enrollment and revenue effects of proposed changes in the tuition reciprocity agreement between Minnesota and Wisconsin, concluding that a proposed tuition surcharge would not adversely affect freshman enrollments for Wisconsin residents attending the University of Minnesota. With few studies focusing directly on reciprocity agreements, the next closest area of research falls under "tuition discounting." Tuition discounting involves awarding institutionally funded financial aid in the form of grants and scholarships to students. Using national data, Long (2004) demonstrated how the amount and distribution pattern of discounting strongly affect enrollment yield, and that if the subsidies could instead be applied to any in-state college, up to 29% more students would prefer to attend private four-year colleges. Dickson and Pender (1987) showed that tuition discounts for non-citizens in the state of Texas has a positive effect on their enrollment at a number of public institutions in the state and a negative effect on enrollment at one private university whose tuition was unchanged by the policy. Kane (2007) demonstrated the impact of discounting in an urban demographic by establishing that the enrollment effects of the District of Columbia Tuition Assistance Grant program was largest at nonselective public four-year colleges and predominantly black institutions. Analyzing data from the National Postsecondary Student Aid Study, Davis (2003) found that an unintended consequence of tuition discounting is that it may reduce lower-income students' likelihood to choose a private college.

Less prominent in the research are studies on the revenue management purposes of tuition discounting. Martin (2002) examined the conditions in which enrollment growth due to discounting can adversely affect institutional finances, even in the presence of excess capacity. Using national data from the Integrated Postsecondary Education Data System (IPEDS) collected by the National Center for Education Statistics, Martin approximated the optimal discounting rate for Carnegie I institutions by setting discounts up to the point where the marginal revenue less the average discount is equal to marginal cost. More recently, Hillman (2012) estimated that when unfunded tuition discount rates exceed approximately 13%, institutions may experience diminishing revenue returns. In one of the few studies that analyzed institutional-specific data, DesJardins (2001) modeled the discounting effects on non-resident students that received a special scholarship at the University of Iowa. DesJardins discussed a range of possible outcomes resulting from the new policy, including estimates of non-resident student enrollments, changes in the class quality, and tuition revenue projections.

It is possible that students' perceptions about college costs may differ depending on whether they are awarded tuition discounts or reciprocity discounts. In their research on student college choice, St. John, Paulsen, and Starkey (1996) identified patterns of decision-making behavior and demonstrated how students may respond differently to financial aid in different settings. Berger (2000) postulated that students with similar levels of capital resources will make similar choices (e.g., which college to attend, whether to go full-time or part-time, whether to drop out, stop out, transfer, or graduate) after entering college. Hence, we expect students in similar settings, with similar resources and financial expectations, to make similar types of decisions and respond to aid packages in similar ways. In our context, this implies that reciprocity students tend to live in the same state and may demonstrate collective behaviors in terms of their enrollment choices. These students may perceive the reciprocity benefit as a "sticker price" discount and a form of categorical recognition rather than individual recognition that comes with a traditional scholarship or grant. This may in turn create a sort of "loyalty" effect to an entering class of reciprocity students.

However, previous studies are not without their limitations. Due to the endogeneity of college costs with enrollment status, it is difficult to accurately estimate the causal link between cost and enrollment probability. Selection bias is a common problem besetting financial aid research and can be introduced, for example, when an institution has financial aid information only for students who apply for aid or that enroll. Cellini (2008) emphasized a number of matching techniques commonly employed to address the problem of selection bias in financial aid studies. Omitted variable bias due to insufficient statistical control is another problem common in price response and financial aid studies. In their review of the research since 1991, Hossler Ziskin, Gross, Kim, and Cekic (2009) identified thirty-two "high quality" studies on the impact of financial aid, but few (if any) offer evidence of how campus social integration, student motivation, and academic success interact with financial aid. Similarly, only a few of the covered studies took into account both estimated family contribution (EFC) and remaining need. Lack of statistical control limits the finding in a recent study linking receipt of need-based aid (including subsidized loans) to higher student dropout (Gross, Hossler, Ziskin & Berry, 2015).

Addressing DesJardins's work (2001), this single-institution study seeks to provide an estimate of WUE student price responsiveness and the effect of the tuition discount on out-of-state enrollment and tuition revenue at a public four-year flagship university. To this extent, the analysis examines whether the WUE tuition discount alters a student's likelihood of enrollment after controlling for relevant student experience and background characteristics. Additional estimates of non-resident student enrollments, changes in the class quality, and net tuition revenue are provided. To address limitations in previous studies, we include other relevant factors associated with student motivation and ability to manage cost of attendance.

About WUE

WUE is coordinated by the Western Interstate Commission for Higher Education (WICHE). WUE is a regional tuition-reciprocity agreement that allows students from WICHE states to enroll in more than 150 participating two- and four-year public institutions at 150% of the enrolling institution's resident tuition (Western Interstate Commission for Higher Education, 2013). WUE is the largest program of its

kind in the nation and has been in operation since 1987. WUE is not a short-term exchange; instead, it is meant to be used for students pursuing a full undergraduate degree. WUE member states include Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming, and the Commonwealth of the Northern Mariana Islands. Approximately 36,000 students participate in WUE each year.

Gauging the Influence of WUE Tuition Discount on Yield

To estimate whether the WUE tuition discount alters the chance of student enrollment, we examined data for admitted new freshmen at a state land-grant research university for fall 2015. For that term, the moderately selective institution admitted 7,853 new freshmen by August 1, of which 7,810 were admitted by June 1. Of those, 3,033 enrolled in coursework, resulting in a yield of 39%. Enrollees had a slightly higher average entry test score (23.9 ACT) compared to non-enrollees (23.7 ACT). To help isolate the estimated effect of the WUE discount, the analysis focuses on admitted students with a completed Free Application for Federal Student Aid (FAFSA), which offers insight into students' financial burden associated with the cost of college attendance.

The analytical framework is informed by the scholarship on the effects of financial aid and tuition discounts on student outcomes (DesJardins, 2001; Hayes, Price & York, 2013; Hossler et al., 2009; Johnson, 2013). Accordingly, the analysis accounts for student socioeconomic background, pre-college academic preparation, choice of college major, participation in institutional recruitment activities, and a student's financial aid profile as reflected in the FAFSA data. To estimate the chance of enrollment for admitted students, the analysis controls for the following factors: Student gender and race/ethnicity (including non-white status for black, native Americans, and Pacific Islander students combined; Asian status, Hispanic status, and multiethnic status); student residency (including local area students within commuting distance of campus; in-state students outside the local area; and out-of-state students with WUE tuition discount, with full-pay out-of-state students being the reference category); admission test score (on ACT Composite scale) and high-school core-weighted GPA; test score date measured as number of weeks prior to start of college; the student's college major categorized by academic field (undeclared major being the reference category); and student participation in recruitment activities.

Inclusion of indicators for six distinct recruitment activities a student may have participated in is designed to gauge the influence of student knowledge about the institution and its programs. The indicator NVBound measures participation in a recruitment program that offers prospective students (and parents) the opportunity to spend a full day on campus in order to meet academic faculty and program directors, tour the campus, have lunch, visit with housing and admission personnel, and receive assistance from the financial aid office. This program is available to both in-state and out-of-state students and covers transportation to and from the campus. The Preview program offers off-site presentations about all key aspects of the institution to assist prospective students in their decision making. College fair programs allow prospective students to consult with recruitment personnel at events that host recruitment teams from other institutions. High-school visit programs offer prospective students the opportunity to consult with recruitment personnel at their high schools. The Campus Walking program provides students the chance to take part in a formally scheduled guided tour of the

university campus. The onsite admission program offers prospective students the opportunity to have their high-school transcripts evaluated for an immediate admission decision during an in-person campus visit (instead of the online admission process).

Other factors included in the analysis are the student's capacity to pay for cost of attendance as measured by the EFC listed on the FAFSA (i.e., categorized into "high," "medium," and "low" level, the latter being the reference category); an indicator for whether or not a student accepted a financial aid loan as documented on the FAFSA form; the level of unmet financial need (i.e., the difference between the cost of attendance and all accepted financial aid as based on the FAFSA), with indicators for low, medium, and high level (no unmet need being the reference category), and the timing of the student's financial aid application (i.e., number of weeks prior to start of college). The influence of unmet need is estimated also separately using a continuous metric (dollar amount); similarly, the effect of participation in recruitment activities is measured separately with a continuous metric based on how many of the six activities a student took part in. As indicated, all the financial data are sourced from the FAFSA form, while the other data originate with the institution's matriculation and recruitment management system.

Using statistical regression, we first estimate whether or not admitted out-of-state applicants receiving the WUE tuition discount are more likely to enroll compared to out-of-state students without the discount. If there is a significant effect associated with WUE status, we estimate the influence of the tuition discount on enrollment probability of WUE students. We exclude applicants on foreign student visas, as they are not eligible for federal financial aid, and we exclude 172 and 63 statistical outlier cases in the first and second step of the estimation, respectively (based on Mahalonobis' chi-square critical value). Both estimation models exhibited limited collinearity associated with covariate selection (all VIFs < 3; see Allison, 2012), and the data fit the estimation models well (Hosmer-Lemeshow > 0.05), explaining between 23% and 41% of the variation in enrollment status.

<COMP: Place Table 11.1 Here>

Table 11.1 shows the results of the logistic regression model to estimate the influence of WUE status on enrollment likelihood compared to out-of-state students with no tuition discount. Accordingly, students that qualified for the WUE discount are significantly more likely to enroll. Conversion of the listed odds ratio (19.6) using Cruce's formula indicates that WUE students are 57% more likely to enroll than out-of-state students that do not receive the tuition discount, *ceteris paribus* (Cruce, 2009). Of the factors included in the estimation model, WUE status is the most significant one, followed by whether or not a student resided within commuting distance of campus, whether or not a student resided inside the state but outside the local commuting area, and whether or not a student accepted a financial aid loan to pay for college. Thus, in-state students are more likely to enroll than out-of-state students without tuition discount. In contrast, out-of-state students that do qualify for the WUE discount are as likely to enroll as in-state students.

Other factors included in the analysis that exert a significant influence on enrollment are student age, admission test score, test date, student participation in institutional recruitment activities, and student income background and financial aid need. Students at least 19 years of age are slightly more likely to enroll (OR = 1.5) than those 18 years of age or younger at the start of college. Conversely, students with higher test scores are slightly less likely to enroll. Specifically, a one-point rise in the ACT score changes

the odds of enrollment by a factor of 0.97. Admitted students that participate in any one of three recruitment activities have greater odds of enrollment than non-participants. Conversion of the respective odds ratios (2.1, 2.2, and 1.9) shows that participation in recruitment activities raises the likelihood of enrollment by 16%–19%. Participation in multiple activities has a cumulative positive effect (OR = 1.6 for each additional activity). Compared to students with limited capacity to pay for college—namely, those in the lowest third of the EFC distribution—students with greater capacity to pay for college (i.e., those in the top third of the EFC distribution) are more likely to enroll (OR = 1.3). In contrast to students with no unmet financial need, those facing a low amount of unmet financial need have greater odds of enrollment (OR = 1.6), while those with a medium or high amount of unmet need are no more likely to enroll than students with no unmet need. The model estimates that academic major, gender, race/ethnicity, and high-school GPA have no bearing on a student's chance to enroll. Similarly, the timing of the financial aid application exhibits no significant influence on likelihood of enrollment, while the timing of the admission test is significant but exerts a minimal effect on enrollment.

Since the WUE tuition discount emerged as a highly significant factor associated with the probability of enrollment, we proceed with an estimation of the price-response effect due to the discount. Price elasticity of demand is a measure used in economics to show the responsiveness, or elasticity, of the quantity demanded of a good or service to a change in its price, *ceteris paribus* (Jackson & Weathersby, 1975; Leslie & Brinkman, 1987). Thus, we estimate the change in enrollment probability associated with the reduction in tuition charge for discounted students. To this end, we limit the analysis to out-of-state students that were offered the WUE discount and examine the effect associated with the amount of unmet financial need. Unlike the amount of total tuition charges, the amount of unmet need measures more directly a student's financial challenge to meet total cost of attendance in order to enroll. We know from the foregoing results for all admitted students that for every $1,000 in unmet financial need, the odds of enrollment are on average not significantly affected (OR = 0.99, see Table 11.1). If WUE-discounted students exhibit the same level of demand elasticity for higher education as the *average* admitted student, we would expect to find a similar price response.

<COMP: Place Table 11.2 Here>

Table 11.2 lists the estimated effects on enrollment for students with WUE-discounted tuition. Results show that for every $1,000 in unmet need, the odds of enrollment drop on average by a factor of 0.87, which equates to a 2% decline in the probability of enrollment (using the conversion formula by Petersen, 1985). This suggests that WUE-discounted students are on average more price-responsive than admitted students in general. Moreover, given that the amount of unmet need is statistically more significant than any other factor included in the analysis (Wald = 22.9), it is reasonable to assume that the WUE tuition discount looms large in a student's determination on whether or not to enroll at the institution. Results also show that discounted student enrollment is significantly heightened after participation in the NVBound recruitment program, estimated to increase the chance of enrollment by 9% (OR = 2.6). For tuition-discounted students, selection of an academic major also matters. Compared to undeclared students, those selecting engineering and the group of students who chose either education, health sciences, journalism, or liberal arts are more likely to enroll (OR = 4.9 and 2.9, respectively). In contrast, the odds of enrollment for students who picked a science major is about half compared to undeclared students (OR = 0.5). Among WUE-discounted students, those who can afford

more easily to pay for college (i.e., with a high EFC level) are more likely to enroll than students pressed to pay for college (i.e., with a low EFC level). As is the case for admitted students in general, WUE-discounted students with higher test scores are slightly less likely to enroll, while those who start the financial aid application process early are marginally more likely to enroll.

To render the findings operationally meaningful to university administrators and decision makers, the researchers relate the estimated enrollment impact of the WUE discount to a proposed policy to raise eligibility requirements for the discount and to create a new lower tuition discount for admitted students that may not meet the new requirements. As part of more proactive enrollment management, the institution proposed to increase the minimum high-school core-weighted GPA from 3.0 to 3.25 and the minimum test score from an ACT composite (or SAT-equivalent) of 22–26. Concurrently, a new scholarship would be established for admitted students from WUE-member states with a minimum 3.0 GPA and minimum 22 ACT score but who fail to meet the new requirements. This scholarship would be equivalent to a 200% in-state tuition rate, compared to the 150% in-state rate for the WUE discount, with the non-discounted out-of-state rate set at 324% of the in-state rate (Nevada System of Higher Education, 2015). While the institution hopes to increase both the average level of academic preparation of new students and associated tuition revenues, the proposed policy change in WUE eligibility engenders the risk of failing to enroll admitted students that no longer qualify for the WUE discount and who may not enroll with the reduced "discount" under the new scholarship.

<COMP: Place Table 11.3 Here>

To gauge the likely impact of a tightened WUE eligibility for out-of-state students from member states, the researchers estimate out-of-state student enrollment and associated tuition revenues under the proposed policy with the same cohort of new freshmen from the foregoing analysis. Table 11.3 compares the number of enrolled students and tuition revenues in fall 2015 (upper panel) with numbers that take into account the estimated price response of students with the WUE discount had they not qualified for it under the proposed policy (lower panel). There are 899 WUE-discounted students that enrolled in fall 2015, generating $8.9 million in tuition revenue. The additional 436 out-of-state students without the discount bring the total revenue to nearly $18 million. Under the proposal policy, only 279 would qualify for the WUE discount, while the remaining 620 would meet the new scholarship requirements. Given the estimated drop in enrollment probability of 2% for every $1,000 in unmet need, the effect of the difference in the tuition charge ($13,804 vs. $9,894 for a full-time student) would reduce enrollment to 572 students instead of 620, equivalent to a 3.6% decline in total out-of-state students. However, the newly layered tuition levels are estimated to boost total revenues by $1.8 million, again, *ceteris paribus*.

Limitations

Before proceeding with a discussion of how the findings here inform the research on tuition discount and financial aid, the researchers highlight several limitations in this study. First, results reflect on the enrollment outcome of admitted students at one public research university and thus may not be extended to other institutions that admit students of different academic and socioeconomic background and where the cost of attendance and available financial aid is incomparable. Second, we limit our

analysis to those admitted students that submitted a completed FAFSA form. While FAFSA-derived financial aid information is critical to establish common financial aid metrics for all students in the analysis, it is reasonable to assume that limiting the sample to FAFSA completers introduces selection bias that affects the accuracy of the coefficients of interest. For example, descriptive data of out-of-state students show that FAFSA completers are more likely to qualify for the WUE discount than non-completers. Though selection bias is rarely addressed in financial aid studies (DesJardins, 2001; Hossler et al., 2009; Welbeck, Diamond, Mayer & Richburg-Hayes, 2014), the likely upward and downward bias associated with data for merit-based and need-based assistance and discounts (respectively) may minimize the effect of selection bias in this study, given the inclusion of data that measure the cost of attendance *net* of all aid awarded, i.e., the unmet need (see Dynarski, 1999). Third, anchoring the analysis in cohorts spanning multiple years of college entry would have been preferred, offering greater inferential value and testing of cohort-specific effects. Absence of reliable admissions data for historical cohorts forced the focus on the most recently admitted first-year students. Lastly, while the design of this study is guided largely by the student college choice and financial aid research—suggesting the incorporation of academic, sociodemographic, cost of attendance, and financial aid factors—the presence of significant omitted variable bias cannot be ruled out. For example, indicators of college preference and parent level of education were available for enrolled students in this study, but not for admitted students that never enrolled. Instead, we attempt to address these potential areas of influence with the inclusion of information on student participation in institutional recruitment activities and data on students' ability to pay for college (i.e., levels of EFC), which strongly correlates with parental level of education (Hout, 2012).

Implications

WUE discount is offered on a reciprocal basis to students residing in any WUE-member state. Since the amount of tuition discount is tied to a percentage of the in-state tuition rate, the size of the discount varies with the resident rate charged by each state. Results from this study suggest that the WUE discount has a significant effect on the enrollment of WUE-discounted out-of-state students. Accordingly, a WUE-discounted student is on average 57% more likely to enroll at the focal institution in this study than a non-discounted full-pay out-of-state student. The statistical estimates indicate that an admitted out-of-state student with the WUE discount is at least as likely to enroll as an in-state resident student net of academic preparation, participation in recruitment programs, ability to pay, and level of unmet need. The within-group analysis also shows that WUE students with higher test scores are less likely to enroll; conversely, WUE students with an intent to major in engineering, the liberal arts, or health sciences are more likely to enroll than those who fail to declare a field of study during the admission process.

Participation in an on-campus visit that offers interaction with faculty and recruitment personnel also heightens the chance of enrollment for WUE students. And while the ability to pay for the cost of attendance increases the likelihood of enrollment (based on EFC level), the amount of unmet need on average lowers the odds of enrollment for WUE students compared to admitted students in general. Thus, WUE students are estimated to be more price-responsive than other students.

In the wake of newly proposed WUE-eligibility requirements, the estimated price responsiveness of WUE-discounted students has potential policy implications for the institution in this study. Specifically, how likely is the forecasted impact on future WUE enrollment and tuition revenues given the estimated price response effect that suggests a drop in WUE student enrollment of 2% for every $1,000 in unmet need? Though no comparable studies could be found that address demand elasticity of WUE-discounted students, several related studies help us gauge the likely impact associated with changes to WUE eligibility requirements as discussed here. Examining the effect of an institutional grant for non-resident students at a Midwestern university, DesJardins (2001) estimated non-resident enrollment to rise on average by 7.3% for every $1,000 in grant aid. The effect varies with level of financial need and academic preparation and is estimated to range between 6.9% and 8.6%. Applying the constant-dollar inflator to reflect increases in net tuition at public universities between 1997 and 2015 (College Board, 2015), the effect observed in this study would translate into a 3.8% rise in enrollment for every $1,000 in tuition discount in 1997 (*ceteris paribus*), the cohort year in the DesJardins study. The difference in estimated price response may be due to a number of factors.

Market competition for students likely varies between institutions, with prospective students facing different enrollment choices that influence their price response. Also, student price response varies with the form of aid and the prestige associated with types of aid (Heller, 1997; Hossler et al., 2009; Leslie & Brinkman, 1987). Perhaps most importantly, the estimated effect size depends on the covariate controls in the statistical model. Unlike previous studies, this study measures the influence of student participation in recruitment activities designed to attract out-of-state students, and the findings show that such activities exert significant influence on student enrollment of WUE-discounted students. The effect of student participation in recruitment activities has received scant attention in higher education research. Still, the finding here on the effect of recruitment activity participation is partly echoed in a study by Goenner and Pauls (2006), which shows a positive relationship between student campus visits and inquiry contacts and prospective students' chance of enrollment. Thus, the observed effect of the tuition discount in this study is also influenced by student participation in recruitment activities. Given some collinearity in the estimation model (VIF < 3 for all factors), the combined effect of all covariates typically reduces the effect observed with a single variable. Leslie and Brinkman (1987) estimated the average price response in a meta-analysis of twenty-five suitable studies and concluded that for every $100 increase in tuition charges, the enrollment rate for traditional-age students would drop by 0.7percentage points. Adjusting for the average weighted price level in that analysis (using 1982-year data), and assuming similar average unmet need, this would translate into an enrollment drop of 0.6 percentage points in this study. Therefore, the estimated price response in this study is comparable to the finding in the meta-analysis by Leslie and Brinkman (1987). Still, comparability of the results here with other institutions likely hinges on the institution's price level, academic and socioeconomic characteristics of admitted students, available financial aid, and market competition for similar students.

Another key consideration in estimating student price response is the timing of the captured data that go into the analysis. Institutions have varying application and financial aid process deadlines that govern when students are informed of their financial aid awards. To ensure completeness of that information and reduce any endogeneity associated with incomplete financial aid information, data in this study were captured at the appropriate time (June 1), when the vast majority of awarded aid is documented and communicated to admitted students.

Having simulated tuition revenue generation associated with a change in WUE-discount eligibility, the researchers attempt to gauge the likelihood of the estimated outcome in total revenue generation for the institution. As reported in Table 11.3, raising tuition for WUE-discounted students that fall below the original eligibility criteria, but who qualify for a new scholarship with lesser requirements, would result in an overall increase in tuition revenue of $1.7 million for out-of-state students. This estimate assumes that enrollment of WUE-discounted students would drop by 2 percentage points for every $1,000 in unmet need based on the result from the price-response model (Table 11.2). But how likely is a rise in total tuition revenues for non-resident students given the simulated parameters? According to a recent study that examined the impact of tuition discounts on net tuition revenues, using data from the Delta Cost Project for 174 institutions between 2002 and 2008, a discount rate of approximately 13% is estimated to maximize net tuition revenues (Hillman, 2012). This finding is limited to "unfunded" tuition discounts, namely those paid for by the institution's operating budget, not discounts provided through institutional endowments. Since the WUE discount amounts to a 52% reduction in tuition compared to a full-pay out-of-state student's, we expect limiting the discount to no more than 13% would maximize total revenues from non-resident students. The estimated rise in revenue with the introduction of a new scholarship that offers a 34% discount, instead of the 52%, thus helps increase total revenues, as predicted by Hillman. The fact that the institution in this study proposed a new scholarship that offers a much greater discount than the level estimated to maximize revenues by Hillman may not be surprising. The majority of institutions covered by Hillman did so. Also, the WUE discount, against which the new scholarship must be compared to, cannot exceed 150% of the resident tuition rate. To encourage enrollment of out-of-state students that would no longer meet the WUE-eligibility requirements, the institution set the new scholarship discount well below the midpoint between the WUE-discounted tuition and full-rate non-resident tuition, a level that corresponds to the average total cost incurred by the institution to educate a student. While the institution may have further room to limit the amount of tuition discount in its endeavor to raise revenues—assuming Hillman's finding is suitably instructive— the parallel goal of attracting well-prepared students from across the large area of WUE-member states is equally important. As the findings show, academically better prepared students are less likely to enroll, confirming that these students are coveted by other institutions and are thus harder to attract.

Conclusion

Tuition discounts are an important mechanism for higher-education institutions to attract the type of students they seek to enroll. This study shows that the WUE tuition discount offered to students residing in the western states of the United States exerts a significant influence on admitted students' chance of enrollment. Given the findings from the case institution here, the benefit of the WUE discount easily compensates for the lower odds of enrollment of a full-pay non-resident student. Since WUE eligibility is tied to a student's academic level of preparation, changes to the eligibility requirements allow institutions to more actively manage their enrollment and tuition revenue stream. Like most institutions, the one examined in this study pursues a careful balancing act that aims to concurrently increase tuition revenue and academic reputation through active enrollment management. Results from the statistical estimation suggest that tightening WUE eligibility with simultaneous phase-in of a new scholarship awarded to students that no longer meet the new requirement would mitigate a drop in enrollment and

would generate larger tuition revenues from out-of-state students. The estimated price-responsiveness for WUE students admitted to the featured public, research university echoes earlier findings from studies in the 1990s and early 2000s. Accordingly, estimates from these earlier studies are similar to those observed in this study after controlling for differences in price levels over time. Still, an institution's price level, academic and socioeconomic characteristics of admitted students, available financial aid, and competition for prospective students may significantly influence estimates of student enrollment probability and revenue generation associated with changes to tuition discount eligibility. Findings from this study may generalize well for moderately selective institutions that experience high levels of competition for students and that face a modest inverse relationship between admission test scores and enrollment yield. Results could differ for highly selective institutions with less competition for admitted students and a greater degree of uniformity in test scores. Moderately selective institutions seeking higher-quality cohorts should carefully simulate prospective changes to pricing levels—whether such changes are in reciprocity agreements, scholarship eligibility, or other types of financial assistance—due to the likely range in price response of admitted students at these institutions.

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TABLES

Table 11.1 Coefficient Estimates for Enrollment of Admitted First-Year Students

		Coefficient	S.E.	Wald	Sig.	Odds Ratio
Academic field	Business	−0.130	0.142	0.839		0.878
	Agriculture	0.154	0.162	0.907		1.167
	Engineering	0.162	0.130	1.555		1.176
	Science	−0.135	0.127	1.144		0.873
	Other areas[1]	0.067	0.102	0.434		1.069
Student attributes	Male	0.063	0.084	0.565		1.065
	Age 19 or older	0.395	0.177	4.986	*	1.484
	Non-white[2]	−0.131	0.169	0.605		0.877
	Asian	−0.001	0.142	0.000		0.999
	Hispanic	−0.098	0.099	0.981		0.907
	Multiethnic	−0.003	0.152	0.001		0.997
Preparation	High-school GPA	−0.061	0.085	0.514		0.941
	Test score	−0.031	0.012	6.514	*	0.970
	Test date	0.008	0.002	11.882	***	1.008
Residency	Commuter resident	2.278	0.156	214.606	***	9.757
	Other in-state resident	1.632	0.128	162.140	***	5.116
	WUE student	2.975	0.128	537.568	***	19.582
Recruitment programs	NVBound	0.749	0.089	70.755	***	2.116
	Preview	0.776	0.191	16.543	***	2.172
	College fair	0.067	0.138	0.233		1.069
	High-school visit	0.030	0.109	0.075		1.030
	Campus walking	0.628	0.102	37.505	***	1.873
	Onsite admission	0.594	0.326	3.323		1.810
Financial aid profi	EFC mid-level	0.153	0.106	2.101		1.165

		Coefficient	S.E.	Wald	Sig.	Odds Ratio
	EFC high-level	0.278	0.109	6.487	*	1.320
	Loan acceptance	2.467	0.170	211.761	***	11.793
	Unmet need low	0.482	0.156	9.496	**	1.619
	Unmet need medium	0.213	0.137	2.418		1.237
	Unmet need high	0.032	0.125	0.067		1.033
	Financial aid date	0.007	0.016	0.163		1.007
Separate estimates	Unmet need, $1,000	−0.012	0.007	2.919		0.988
	Multiple recruit programs	0.485	0.049	98.121	***	1.625
	Intercept (constant)	−2.256	0.510	19.559	***	0.105

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; $N = 4,383$.

[1]Includes Education, Health Sciences, Journalism, Liberal Arts.

[2]Includes African American, American Indian, Pacific Islander.

Table 11.2 Coefficient Estimates for Enrollment of WUE-Discounted Students

		Coefficient	S.E.	Wald	Sig.	Odds Ratio
Academic field	Business	0.308	0.396	0.604		1.360
	Engineering	1.587	0.534	8.827	**	4.888
	Science	−0.616	0.362	2.898		0.540
	Other areas^	1.052	0.340	9.572	**	2.864
Student attributes	Male	0.419	0.273	2.353		1.520
	Age 19 or older	0.784	0.800	0.961		2.190
	Non-white~	−0.351	0.585	0.361		0.704
	Asian	−0.452	0.485	0.867		0.636
	Hispanic	−0.114	0.352	0.105		0.892
	Multiethnic	0.919	0.629	2.135		2.508
Preparation	High-school GPA	0.374	0.349	1.147		1.454

	Test score	−0.115	0.054	4.444	*	0.892
	Test date	0.008	0.009	0.883		1.008
Recruit. Programs	NVBound	0.966	0.326	8.804	**	2.628
	Campus walking	0.410	0.264	2.420		1.507
Financial aid profile	EFC mid-level	0.601	0.325	3.418		1.824
	EFC high-level	1.226	0.335	13.402	***	3.406
	Financial aid date	0.100	0.048	4.317	*	1.106
	Unmet need, $1,000	−0.138	0.029	22.851	***	0.871
	Intercept (constant)	−0.778	2.426	0.103	0.748	0.459

$* \ p < 0.05, ** \ p < 0.01, *** \ p < 0.001; N = 744.$

[1]Includes Education, Health Sciences, Journalism, Liberal Arts.

[2]Includes African American, American Indian, Pacific Islander.

Note: Some factors from first model (Table 11.1) omitted due to lack of variance.

Table 11.3 Estimation of Enrollment and Revenues for Out-of-State First-Year Students

Status	Eligibility Requirements	Headcount	Tuition Rate	Revenues
WUE	≥3.0 GPA and ≥22 ACT3* at 150%	899	$9,894	$8,894,706
Full pay	All others	436	$20,812	$9,074,032
		1,335		$17,968,738
WUE	≥3.25 GPA and ≥26 ACT3 at 150%	279	$9,894	$2,760,426
New scholarship	WUE state, ≥3.0 and ACT3 ≥22 at 200%	572	$13,804	$7,893,151
Full pay	All others	436	$20,812	$9,074,032
		1,287	$1,287	$19,727,609
	Change from current WUE criteria			$1,758,871
	Drop in student enrollment	47 (3.6%)		
3or SAT equivalent				