Research in Higher Education (© 2006)
DOI: 10.1007/s11162-006-9015-6

HOW DO STUDENTS CHOOSE A UNIVERSITY?: An Analysis of Applications to Universities in Ontario, Canada

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This study uses a unique set of microdata on university applications to examine the role played by institutional attributes in choices made by graduating high school students between the 17 universities in the Province of Ontario, Canada. We estimate a rank-ordered logit model that uses all information contained in each applicant's ranking of institutions. Applicants prefer universities that are closer to their homes, spend more on scholarships and teaching, and offer higher levels of non-academic student services. Smaller class sizes are preferred by female applicants but not by males. High levels of research activity discourage applications. Smaller, primarily undergraduate institutions suffer from a low placing in the annual national university rankings but larger universities do not.

KEY WORDS: rank-ordered logit; university choices; school characteristics; Canada.

University education in Ontario, Canada's largest province, is delivered through 18 publicly funded, degree-granting institutions (only 17 existed at the time the data used in this paper were generated). Although they vary considerably in size, from slightly more than 5000 students in 2003 to almost 70,000, the province's universities tend to be more similar in character than is the case in most other jurisdictions and their degrees tend to carry a similar currency in the labor market. The province's funding formulas, which provide almost 50 percent of operating revenue, are designed to ensure uniform tuition fees across institutions except in the cases of certain professional like business and medical programs.

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Each year approximately 60,000 high school students apply for admission to one or more of these universities. With revenues almost entirely enrolment driven, each institution has a critical financial interest in its share of the undergraduate market and, therefore, in how those students choose among the available institutions. It is fair to say that those choices remain rather poorly understood since little research has been done on this topic in Canada or other jurisdictions. Does average class size matter? What impact does the scholarship budget have in attracting students? Do the Maclean's university rankings (the Canadian equivalent to the *U.S. News and World Report's* college rankings) affect student choices?

Applications to the province's universities are made through a centralized facility (Ontario University Application Centre) established by them. A fixed fee permits up to three choices, with an unlimited number of applications beyond that for a constant marginal cost. This centralized applications process generates a rich set of data on student preferences that has been relatively unexplored and that is unique in capturing the demand side of the educational market. Almost all studies into the demand for post-secondary education are forced to use enrolment data (see, for example, Heller, 1997 or Leslie and Brinkman, 1987). As is well-known, however, actual enrolments are the joint product of decisions by individuals to apply to an institution and that institution's decision about whether or not to let them in. Although we recognize and attempt to deal with the possibility that some application decisions may be conditioned on the expectation of receiving an offer of admission, and therefore are affected by rationing on the supply side, this dataset nevertheless is as close to an ideal reflection of the demand side as we are likely to get.

The applications data have an additional advantage over the more aggregate, institutional applications totals often used (see, for example, Mueller and Rockerbie, 2002) in that the former are micro-data. Were we restricted to observing only the total number of observations received by each university in the province, only 17 observations would be available in each year. To achieve any precision in the statistical estimates, data would be required over a number years and would introduce the complications associated with combining cross-section with time-series data. Neither would we be able to deal appropriately with the role of distance in determining the attractiveness of an institution to an applicant or with the effect of that applicants scholarly ability as reflected in high school achievement.

Having made reference to Heller and Leslie and Brinkman, it is worthwhile noting that we are not about to estimate the demand for

education. Rather, we are dealing with individuals who have made the decision to acquire a university education. The decision we are analyzing is about which institution to attend, much as one might analyze the decision about what brand of automobile a consumer would choose. In this article, we model student choices as being conditioned on the attributes of individual institutions as we seek to determine the factors that influence their choice of preferred institutions. Using a rank-ordered logit model, we explore the role of distance, university quality, and other university attributes, including university rankings, in shaping the preferences of applicants. We find that applicants prefer universities that are closer to their homes, spend more on scholarships and teaching, and offer higher levels of non-academic student services. Smaller class sizes are preferred by female applicants but not by males. Universities that have a strong reputation for high levels of research activity discourage applications. Smaller, primarily undergraduate institutions suffer from a low placing in the annual national university rankings but larger universities do not.

LITERATURE REVIEW

The literature concerning the choice of whether or not to pursue post-secondary education is vast, but of little relevance to this paper since we are examining the choices between institutions being made by individuals who have already decided to continue schooling at the university level. There is a considerable body of work examining the college choice process among American students, exemplified by the papers contained in Hoxby (2004) and summarized by Cabrera and La Nasa (2000). The primary focus of this literature is role played by personal attributes, including parental background, socio-economic status, and so on in the decision-making process. For those choosing to attend college, the subsequent choice is one made between types of colleges: 2-year versus 4-year, public versus private. This is not a particularly relevant categorization for Ontario universities, which are all public and offer primarily 4-year degrees. High school graduates in the province wishing to invest less time in post-secondary education or wishing more vocational programs typically find their way to the province's system of community colleges. Nor does this more aggregate categorization of choices allow us to explore the role of the characteristics of individual institutions in attracting students.

Reflecting the state of data availability, most studies of school choices at the individual school level have used institution-level data on total applications to determine the effect of school attributes. For example, Bezman and Depken (1998) relate applications to 772 U.S. colleges to

school characteristics, finding a positive relationship to student quality, the graduation rate, expenditures per student, and, counter-intuitively, the student-to-faculty ratio. Applications increase with out-of-state tuitions but decrease as tuition for in-state applications rises. Monks and Ehrenberg (1999) infer the reactions of applicants to changes in the college rankings of 30 top-ranked, private universities by examining the latters' admission outcomes and aid-adjusted tuition. A deterioration in an institution's ranking results in a higher admit rate, a lower graduation rate (indicating a class of lower quality), and decreases in net tuition, all of which are expected. Mueller and Rockerbie (2002) are similarly focused on the role of national rankings rather than wider institutional attributes and use applications to institutions in Ontario (which are, interestingly enough, aggregates of the data used in this paper) to assess the impact of the rankings. They find that an improvement in a university's ranking generally increases the number of applications received from both genders of applicants and across universities of different size.

Manski and Wise (1983) represents the seminal work using microdata to examine the choices individuals make about which institution to attend. Although acknowledging the advantage of a conditional logit approach, computational limitations of the time restricted them to using multinomial logit regression analysis which uses individual-specific characteristics as variables rather than choice-specific attributes. Only recently have conditional logit models been applied with success. Montgomery (2002) models choice between graduate business schools, finding significant effects of cost, location, and school quality in the expected direction. Long (2004) nests a conditional logit model of which institution to attend within a logit model of whether to attend college at all and estimates the models using data from 1972, 1982, and 1992. For those individuals choosing to attend, the importance of cost and distance in the choice between institutions declined while college quality and per student expenditures played a larger role in 1992 than in 1972. Finally, Avery and Hoxby (2004) apply a conditional logit model to data derived from an original survey of academically talented high school seniors and find the expected impact of net cost and institutional quality, where the latter is proxied by mean SAT scores. Interestingly, their results show that distance did not matter to those surveyed.

EMPIRICAL STRATEGY

To explore how students make choices between universities, we use a rank-ordered logit model. The model was first proposed in the economics

literature by Beggs, Cardell, and Hausman (1981), building on McFadden's (1974) conditional logit model. The term "exploded logit model" appears to be preferred in the marketing literature where it was independently developed. In this model, the student is presented with J alternatives which must be ranked. For ease of discussion, assume that all alternatives are ranked and there are no ties, so that the individual i provides a rank for each alternative j, Y_{ij}. Thus, for each individual applicant, Y_{ij} takes on an integer value from 1 to J with 1 indicating the most preferred university and J being the least preferred.

As in the case of multinomial and conditional logit models, the rank-order logit can be motivated by a random utility model. For each alternative j, an applicant i associates a level of utility U_{ij} which is composed of a systematic and a random component.

$$U_{ij} = \mu_{ij} + \varepsilon_{ij}. \tag{1}$$

The systematic component, in turn, is assumed to be a linear function of the characteristics of the individual, X_i, and of the attributes of the university, Z_{ij}. Although many of the university attributes, such as tuition levels and resources available are common to all applicants, the Z vector is double subscripted since some of its elements, such as distance, may be specific to the individual–university pair. Thus, the utility individual i derives from alternative j is written in linear form as

$$U_{ij}(Z_{ij}, X_i) = \beta Z_{ij} + \delta X_i + \varepsilon_{ij} \quad j = 1, \ldots, J, \tag{2}$$

where β and δ are the parameters of interest. In other words, these parameters will capture the impact on utility of changes in the values of university attributes or personal characteristics.

The values of U_{ij} are unobservable and are therefore assumed to be random variables (hence the name *random utility*). However, we can observe the choices individuals make and making a suitable assumption about the error term in (2) allows us to compute the probability that a particular university has the highest utility among all universities in the choice set. In other words, if university l is ranked higher than k, then we know that $U_{il} > U_{ik}$. Consider the highest ranked university. Under the assumption that the ε_{ij}'s are independent and follow an extreme value type I distribution, it can be shown that

$$\Pr[\mu_{il} > \max(\mu_{ij \neq l})] = \frac{e^{\beta Z_{il} + \delta X_i}}{\sum_{j=1}^{J} e^{\beta Z_{ij} + \delta X_i}}. \tag{3}$$

Note that Z_{ij} varies across universities and, for some elements, across individuals but X_i consists of the characteristics of the individual

applicant and will be the same for all choices. Since the characteristics of the individuals do not vary across the alternatives, X_i will fall out of the probability. This is a feature of the conditional and rank-ordered logit models that often renders interpretation difficult but is a natural consequence of the fact that these models assume that the parameters of the value function are equal across individuals. Only the random component of utility is allowed to vary. If one wishes to determine how preferences vary with the characteristics of individuals, then the model must either be estimated separately for different groups of applicants or interactions must be created between university attributes and the characteristic of interest. We have used the former approach to look at high and low academic achievers, and at male and female applicants.

Equation (3) allows maximum likelihood estimation of the parameters for a conditional logit model that analyses the best choice made from a set of alternatives. Essentially, any choice of values for the coefficients β and δ in Eq. (3) produces a set of predicted probabilities of choice for each individual in the data. The estimated values of these coefficients are those that minimize a loss function applied to the deviations of these predicted probabilities from the individuals' actual university choices. Intuitively, estimation compares the characteristics of the chosen university with those of the institutions that are not chosen. If a particular attribute is usually more prevalent in the chosen option, it is estimated to positively affect the choice of university.

An extension to the rank-ordered logit wherein a complete set of rankings is provided, as opposed to only the first choice, is straightforward. The second best alternative is simply the best of the elements in the choice set remaining after the first choice is removed. One can consider a conditional logit model being applied to the remaining alternatives. The product of the likelihood functions for the first and the second choice alternatives then becomes the likelihood for their joint probability. Similarly, the third ranked alternative is the best of the choices available after the first two are removed and so on. The appropriateness of the name "exploded logit" is apparent.

DATA

Estimation of the model requires that we have access to individual rankings of universities. Under normal circumstances, this would be informationally demanding but the process through which Ontario residents apply for spaces in the Province's universities generates precisely these rankings. Each year, full-time high school students, mature students, and students from other types of post-secondary institutions

intending to enroll at an Ontario university submit their applications through the Ontario Universities Application Centre. OUAC is a non-profit organization established by the province's universities to centralize the processing of applications. A fee of $100 entitles applicants to submit three choices of university program after which $33 is charged for each additional choice up to a maximum of 20. This exceeds the number of universities in the province since students may submit applications for different programs within the same institution. It is important to note that applicants are instructed to submit their applications in the order of preference. In this article, we use applications data for entry in the 2001–2002 academic year, so that the choices we are examining were made in the winter of 2001.

For those applicants from high schools, grades data on the final 12 courses taken by the student are submitted to OUAC by their schools and are merged into the microdata file. Additional personal information includes a high school identifier, age, gender, home postal code, citizenship and mother tongue. Applications are followed through to the final registration process. Universities report to OUAC whether or not an offer of admission was made to the student, whether the applicant accepted this offer and whether the applicant eventually registered in the program.

Some features of the data require discussion. First, since additional applications beyond the first three involves a marginal cost, it is costly for an applicant to provide a complete ranking of all universities in the province and not surprising, then, that very few do. Table 1 reports some descriptive statistics for the sample and indicates that the average number of applications made by each applicant is 2.77. This presents no difficulty for the estimation since we can assume that those universities to which no application was made are ranked lower than the last choice university for any individual. Under this assumption, unranked alternatives are not discarded but are used in the estimation.

A more substantive issue arises when we try to define the choice set prior to estimation. Not all universities in the province offer a complete range of programs so that, if a student wishes to pursue studies certain program areas such as journalism, architecture, or engineering, only a subset of universities would be considered as possible destinations. One perspective would suggest that universities not offering these programs should be included in the choice set of all applicants, ranked below those that do because of their failure to provide the program of interest. However, since we are primarily interested in institutional attributes that span all universities, such as quality or expenditures on teaching, the data have been restricted to those individuals applying to arts and

TABLE 1. Descriptive Statistics

Institutions		
Variable	Means of Universities	Standard Deviation
Distance (miles)*	273.3	241.67
Scholarship Spending	$737.05	406.50
Compulsory Fees	$521.57	165.31
Instructional Spending	$6717.13	1154.29
Entering Average	80.4%	4.09
Small Classes	42.3%	13.43
Faculty Awards	3.78	3.37
Rank – Category 1	5	2.83
Rank – Category 2	5.5	2.29
Rank – Category 3	12.3	6.72
Applicants		
Number of applications		
Mean	2.77	
Standard Deviation	1.30	
Minimum	1	
Maximum	15	

*Average distance between each pair of applicant and institution.

science programs which are offered by each of the province's institutions. Our final sample then consists of 27,981 individuals who completed high school in the spring of 2001 and who applied to enter an Ontario university in the fall of 2001.

The restriction to individuals applying to arts and science programs does hamper our ability to find tuition effects since provincial tuition fee regulation results in uniform tuition levels across these programs. Significant variation in tuition across universities occurs only in some selected professional programs for which these regulations do not apply. However, very few programs had been deregulated in 2001 so there not a great deal lost when these programs are excluded. In the remaining observations, differences in compulsory ancillary fees do provide some variation in cost across universities, albeit minor.

Turning to the explanatory variables, there are essentially three broad categories of attributes to be used as covariates in the following estimation; measures of the cost of attending each university, measures of institutional quality, and each institution's ranking in the annual Maclean's report. Particularly in the case of institutional quality, it is possible to include a wide range of measures of resources expended by

any institution that impact on student well-being. Spending on instructional salaries is an obvious measure, but applicants may also be attracted by the physical environment of the campus so physical plant expenditures might also be included. In selecting our explanatory variables, we have attempted to span the three broad categories mentioned above and tried to include variables used in the literature (for example, in Long (2004)) but have also had to be be parsimonious in order to avoid issues of multicollinearity. Table 2 reports the correlation coefficients across the seventeen universities for the institution-specific explanatory variables used in estimation with their associated tests of significance. After calculation of variance inflation factors (available upon request), we are comfortable that multicollinearity is not a significant issue.

As noted, provincial regulations result in common levels of tuition in arts and science programs and prevent us from examining the impact of differing tuition costs on choice. Compulsory non-tuition fees for transportation, athletics, and so on, are not regulated and do vary across universities. These fees averaged 13.4% of tuition levels in 2001, ranging from a low of 7.2% to a high of 18%. While only a fraction of the value of tuition, these amounts may nevertheless be substantial enough to influence choice and provide some means of leveraging the effect of cost out of the data.

Additional variation in effective tuition across universities may be produced by differences in the availability and size of scholarships or bursaries. In Canada, scholarships refer to merit-based student aid and bursaries are need-based aid. Scholarship offers received by applicants are not included in the data and it is therefore not possible to calculate individual-specific, discounted tuitions. We have used instead the total spending by each university on scholarships and bursaries (on a per student basis) to pick up net tuition differences.

TABLE 2. Correlation Coefficients

	Sch. Spending	Compulsory Fees	Instruct Spending	Entering Avg.	Small Classes	Faculty Awards	Rank
Sch. Spending	1.000						
Compulsory Fees	.4103	1.000					
Instruct. Spending	.4409	.1759	1.000				
Entering avg.	.5860	.4848	.7195	1.000			
Small classes	.1589	.1720	−.2354	−.2819	1.000		
Faculty awards	.6574	.5891	.5420	.6155	.1590	1.000	
Rank	−.5082	−.6071	−.5740	−.7795	.1186	−.6604	1.000

The final set of cost factors consists of out-of-pocket and psychic costs, both of which we assume can be proxied by the distance between the applicant's home and the institution. To determine distances between the applicants' home address and each institution, we use Statistics Canada's Postal Code Conversion File which provides latitude and longitude coordinates for each code. These coordinates were used to calculate, for each applicant, the straight line distance to each university from their home address postal code. For urban postal codes, these distances should be fairly accurate, but we must acknowledge that some rural codes are very large geographical areas. Since the latitude and longitude refer to the mid-point of the postal code area, distances for applicants from rural areas may not be accurate.

Some of the financial attributes of the universities (described below) are derived from data reported by them to the Committee of Financial Officers of Universities of Ontario (COFO-UO) in standard format and using common accounting procedures. Financial data are supplemented by statistical data submitted to Maclean's in the annual construction of university indicators.

We include a number of different, complementary measures of school quality. Total instructional expenditures, expressed in per student terms, capture all direct costs of faculties, academic departments, and other academic functions. These expenditures are made available to the Council of Ontario Universities by universities using a common accounting procedure. To investigate the effect of class size on an institution's attractiveness, and to augment the measure of resources devoted to teaching, we have included the percentage of first year classes that are smaller than 25 students. The average entering grade of incoming students captures both the quality of the student body as well as a measure of exclusivity. Finally, each university's effort and success in research is measured by the number of research awards (per 1000 faculty) received by its faculty from the three major federal granting agencies in Canada. This last set of attributes is taken from data used by Maclean's in constructing the university rankings.

Finally, to address the issue of these national rankings, we include the institution's ranking in the previous year's issue of Maclean's magazine (i.e., the issue that is available to students at the time they make their applications). Maclean's groups universities into one of three categories: medical/doctoral; comprehensive; and, primarily undergraduate. A university's rank within its group is determined by 22–24 (depending on the category) indicators that are largely based on data collected through an annual questionnaire sent to universities. For medical/doctoral universities, eight student body indicators represent 22% of the weight used

to calculate the overall ranking. These indicators include average entering grade, proportion of entrants with 75% or higher, the proportion graduating within 1 year of the expected time, a measure of retention, the proportion of international students, and so on. A "classes" factor consists of measures of class size and the proportion of classes taught by tenured faculty and receives a weight of 17%. The same weight is attached to four faculty measures (proportion of faculty with doctorates, national awards per full-time faculty, success in attracting grants in the social sciences and humanities, and success in attracting natural science grants). The size of the per student operating budget, the percentage of that budget devoted to scholarships and bursaries, and the percentage devoted to student services receive a combined weight of 12%. Four measures of library resources (total holdings, holdings per student, the percentage of the operating budget allocated to library services, and the percentage of the library budget spent on acquisitions) receive a combined weight of 12%. The remaining 20% of the weight is assigned to reputational measures, including measures of alumni support through gifts to the university and the results of a survey sent to 7057 guidance counselors, corporate CEO's and recruiters, and heads of national and regional organizations.

Within each category of universities and for each of the indicators, the mean and standard deviation are calculated and subsequently used to determine the number of standard deviations away from the mean any particular university is. This distance is converted into a percentile rank score using a cumulative normal probability distribution. For example, if University X has a value of the indicator one standard deviation above the mean of all universities in the category, its percentile rank score is deemed to be 84% since the probability of a normally distributed random variable taking a value no higher than one standard deviation above the mean is 84%. An overall score is calculated using the weighted average of these scores, where the weights are as described in the previous paragraph. This overall score, in turn, establishes an institution's rank as first, second, third, and so on, in the country. Note that three of the variables introduced above to measure quality and cost (entering average, percentage of 1st or 2nd year classes smaller than 25 students, and the number of faculty awards) also enter into the Maclean's ranking. However, together they account for only 23% of the weight used in ranking. Moreover, given the methodology just described they will have a non-linear relationship to the overall rank and their impacts can therefore be separately identified in a regression.

A complication arises here since the rankings are national and reported separately by category of institution. Thus, for example, a

university in the comprehensive category is compared only to other comprehensive Canadian universities and its rank within this group is not comparable to those assigned to institutions in the other categories. We have therefore used three separate variables to capture the rank, one for each category. Note that the ranking variable contains some cardinality since we use the national rankings for the provincial institutions. Thus, two Ontario universities may be consecutive when only that province's universities are considered but may have non-consecutive rank values if they are separated in the national ranking by out-of-province institutions.

RESULTS

Coefficient estimates and standard errors for the rank-ordered logit model are reported in Table 3. The signs and standard errors attached to coefficients estimates have the conventional interpretations but the magnitudes are not immediately meaningful as marginal effects. The marginal effect on the probability of alternative i being the top-ranked choice when one of its attributes, x_i, changes is given by:

$$\frac{\partial P_i}{\partial x_i} = P_i(1 - P_i)\beta. \tag{4}$$

If P_i is fairly small, then the coefficients are approximately equal to the proportionate change in the probabilities,

$$\frac{\partial P_i / \partial x_i}{P_i} = (1 - P_i)\beta \approx \beta \quad \textit{if } P_i \textit{ is small.} \tag{5}$$

If this approximation is not useful, then the results can be reported as elasticities for continuous variables. Elasticities are commonly used in economics to provide unit-free measures of the degree of responsiveness of one variable to changes in another. For example, the elasticity with respect to distance is the ratio of the percentage change in the probability that an institution is most preferred as distance changes to the percentage change in distance. An estimated value of, say, −1.3 for this elasticity would then indicate that a 1% increase in distance between an applicant and a university reduces the probability of that university being ranked first by 1.3%. Finally, the elasticity interpretation is not particularly useful for the Maclean's rankings since these values can only assume unit changes. In this case, we report the proportional change in the probability that an institution will be the most preferred university when the Maclean's rank changes by one unit, i.e., when the university's ranking drops by one. Whatever the interpretative

TABLE 3. Rank-Ordered Logit Estimates

Variable	All Applicants	High School Scholars		
		Both Genders	Male	Female
Distance (100's miles)	−.5197 *(157.15)*	−.4659 *(81.98)*	−.4537 *(42.24)*	−.4709 *(70.23)*
Scholarship spending	.04169 *(26.17)*	.0478 *(17.98)*	.0702 *(13.39)*	.0396 *(12.83)*
Compulsory fees	.0534 *(18.75)*	.0756 *(16.71)*	.0955 *(10.93)*	.0680 *(12.83)*
Instructional spending	.01875 *(27.33)*	.0103 *(8.67)*	.0118 *(5.20)*	.0010 *(7.12)*
Entering average	−.0088 *(2.19)*	.0627 *(9.76)*	.0486 *(3.96)*	.0668 *(8.84)*
Small classes	.0092 *(13.17)*	.0012 *(1.00)*	−.0057 *(2.47)*	.0036 *(2.65)*
Faculty awards	−.1119 *(36.81)*	−.0783 *(15.34)*	−.0908 *(9.13)*	−.0745 *(12.51)*
Rank – category 1	.0003 *(6.00)*	.0007 *(8.85)*	.0013 *(8.88)*	.0005 *(5.09)*
Rank – category 2	.0054 *(0.91)*	−.0359 *(3.81)*	−.0322 *(1.78)*	−.0388 *(3.50)*
Rank – category 3	−.0822 *(32.85)*	−.0841 *(20.11)*	−.0779 *(9.78)*	−.0871 *(17.69)*
Sample size (No. applicants)	27,981	8029	2191	5838
Likelihood ratio	54264.8	25141.3	7298.0	17944.7

z-Scores in parentheses.

presentation, note that the magnitudes will vary as the values of the covariates (and the probabilities) change. In the following tables, all values are calculated for a hypothetical university that possesses the mean attributes in the sample.

The model is estimated for four different groups. The first column in both Tables and 4 reports estimates for all applicants from Ontario high schools applying for arts and science programs. Different universities set significantly different grade requirements for entry and students are well-informed about them. Although students are asked to submit their applications in order of preference, it is quite likely that low ability students with little to no chance of entering a university with high entrance requirements will not apply to that institution. Although its attributes might be highly regarded, the rank-ordered logit model will treat the university as being less preferred to the institutions to which applications were made. The model is therefore re-estimated using only those students whose averaged 80% or more in their last year of high school courses. The rankings of these students will tell us where they want to attend university, not where they think they might be admitted. Finally, the latter group is separated by gender.

TABLE 4. Marginal Effects

		High School Scholars		
Variable	All Applicants	Both Genders	Male	Female
		Elasticities		
Distance	−1.367	−1.235	−1.205	−1.248
Scholarship spending	0.296	0.342	0.503	0.283
Compulsory fees	0.137	0.339	0.649	0.229
Instructional spending	1.212	0.672	0.767	0.649
Entering average	−0.682	4.89	3.791	5.204
Small classes	0.374	0.048	−0.234	0.148
Faculty awards	−0.407	−0.287	−0.334	−0.273
		Percentage Change after Unit Change in Rank		
Rank – category 1	0.055	0.075	0.100	0.070
Rank – category 2	0.005*	−0.035	−0.032*	−0.038
Rank – category 3	−0.079	−0.081	−0.075	−0.083
Pb. of being first choice for average university	.0377	.0298	.0284	.0301

All estimates significant at 5% level except when starred (*).

Three variables capture the cost element of the choice: distance, scholarship spending, and compulsory fees. In all four equations in Table 4, the elasticity with respect to fees is positive and inelastic. For example, the estimated elasticity for both genders, high school scholars suggests that a 1% increase in these fees increases the probability that an institution is most preferred by 0.3%. Recall that tuition fees are virtually the same across all universities and variation in total fees is due to payments for services received by students, such as transportation, athletic programs, and so on. The positive elasticity should not, therefore, be confused with a true price elasticity of demand which measure the price sensitivity of the demand for a well-defined good or service. In this case, the level of services provided to students is not held constant across institutions and what we may be observing is students choosing universities that offer a higher level of services even though it is more expensive to do so.

Elasticity estimates for distance and scholarship spending are as expected, with distance playing a particularly significant role in choice. In Table 1, we reported the average value for distance as being 273 miles. This is the average distance between every pair of applicant and institution. When we examine only first choice universities, we find that the average distance to the first choice institution to be only 121 miles. Everything else the same, students clearly prefer universities closer to home and we interpret this as reflecting the additional costs of living away from home, traveling and so on. The elasticity estimate for the full sample is somewhat higher than is the case for the restricted sample of high school scholars, from which we can infer that applicants with low high school grades focus their applications more narrowly in a geographic sense. There is almost no difference between the genders in the sensitivity of choice to distance. Increases in dollars of scholarship and bursary spending on students lower the effective cost of attending an institution and, as the estimates show, increase its desirability among applicants. In all cases, the relationship between the probability of selection and scholarship spending is inelastic but there are interesting differences across the groups. As we might expect, all applicants taken together are less sensitive to this attribute compared to high school scholars, presumably because many in the former group, having lower grades, would find scholarships to be largely irrelevant. When we look only at applicants with high entering averages, however, we see quite significant differences between males and females with the male elasticity being almost twice as large as that for females.

Turning to measures of institutional quality, it immediately becomes apparent that applicants with low high school grades make very

different choices than do those with high grades. The entering average of a university is regarded in the literature as a measure of selectivity or prestige and, the higher is this average, the more desirable the institution is thought to be. From the estimates in Table 4, this appears to be true as long as the high entrance standards do not bar the door to the applicant. The elasticity with respect to entering average is both positive and large for high school scholars, but is negative for the entire sample of applicants which implies that is must be quite negative for low high school achievers. Clearly, this latter group is making strategic application decisions, choosing not to apply to universities at which there is little chance of admission. Even though these institutions may possess highly desirable attributes, the rank order logit model will treat them as being less preferred by low high school achievers than universities with lower entrance standards since they are not given a ranking by these applicants. It follows that model estimates should be taken from the restricted sample of applicants for whom the full menu of university options is available. For this group taken as a whole, and for each gender within the sample, a higher entering average increases the probability of a top ranking in quite a substantial way. This is particularly true for female applicants, in which case a 1% increase in the entering average of an institution will increase the probability that it is the most preferred alternative by over 5%.

It is worth noting that a university will know whether the application received from an individual represents that person's first choice, second choice and so on, and this opens up the possibility of universities pursuing their own strategic decision-making when making offers of admission. If true, this would have implications for actual admissions data but not for applications data unless applicants somehow anticipate university admissions strategies in ordering their choices. We assume that this does not happen.

Two measures of instructional quality were used in the model: dollars of instructional spending per student and the proportion of first year classes that were small (no more than 25 students). The response to instructional spending is positive, although inelastic, and consistent across the two genders. While small class size appears to matter to female applicants, the elasticity is negative (but, again, quite small) for males. At least for males, our results are consistent with Bezman and Depken's (1998) finding that applicants do not regard low student-to-faculty ratios as positive attributes in a university.

Applicants generally appear to be attracted to universities that can offer them higher levels of instructional quality, but they take a much different view of the level and quality of research undertaken in the

institution. Our measure of research activity produces negative elasticities so that universities with better research performance are regarded as being less attractive to applicants, everything else the same (including prestige to the extent that it is captured in the entering average). It may well be the case that these applicants expect high levels of research activity to produce few benefits for them as undergraduates but exact a cost in terms of faculty who are not fully engaged in teaching.

The results for university rankings, as published by Maclean's magazine produce a mixed message. Recall that the marginal effects reported in Table 4 for the rankings are the proportional changes in the probability that an institution is most preferred resulting from a one unit increase in the value of the rank. An increase in the value of the rank is a deterioration in the university's standing and should produce negative marginal effects if rankings matter to applicants as indicators of quality or desirability. This is not the case for the five provincial universities that have broad doctoral programs and medical schools. For any of these institutions, had their rank been one unit lower there would have been as much as a 10% increase in the probability that they would be regarded as the most preferred destination by applicants. The signs are as expected for universities in the comprehensive and the primarily undergraduate categories, however, with a deterioration in ranking leading to a reduction in the probability of selection as first choice. Moreover, that effect is stronger for primarily undergraduate institutions than for comprehensive universities.

We have, then, a pattern in which applicants appear to behave perversely with respect to national rankings when considering medical/doctoral universities, tend to ignore or treat lightly rankings applied to comprehensive universities, and take rankings seriously when considering primarily undergraduate institutions. Medical/doctoral universities are large and old. Comprehensive universities are of mid-size and primarily undergraduate institutions can be quite small. We interpret the pattern of marginal effects as indicating that the importance of the contribution made by national rankings to applicants' information sets is inversely proportional to the size of the university. Applicants are familiar with the large universities and attach little or no importance to the Maclean's rankings. With only five universities in the category, the unexpected relationship observed in Table 4 may be spurious. At the other end of the size spectrum, applicants may be much less knowledgeable about smaller universities and, therefore, place a greater deal of reliance on purportedly objective measures of quality.

CONCLUSION

The university applications process in Ontario generates a unique opportunity to observe preference rankings across the province's seventeen institutions. With the recent development of statistical models to deal with ranked data, we are in a position to better understand how high school graduates intending to pursue university study choose between institutions.

With uniform tuition fees in the province, out-of-pocket costs vary only with compulsory non-tuition fees, distance to the institution, and scholarship spending that lowers net tuition. Distance and scholarship spending are important to prospective applicants and in the direction we would anticipate. High school students are much more likely to rank a university that is close by as their first choice, everything else the same, and respond positively to increases in scholarship spending. A positive response to higher non-tuition fees is somewhat puzzling. It must be remembered, however, that higher fees may be associated with higher levels of student services that applicants are willing to pay for.

Higher levels of instructional spending increase the likelihood of a university being selected by applicants but, if this higher spending is used to reduce class size, it will have only a small impact on attracting female students and actually reduce the institution's attractiveness to males. While applicants generally care about resources devoted to teaching, higher levels of success in research appear to discourage prospective students from applying. This is true even for high academic achievers who might be considered to have some interest in the research process of a university.

There is clear evidence in the data that high school students are aware that their prospects of admission vary across institutions and act on this knowledge by avoiding applications to universities unlikely to admit them. A university with a high admission standard in terms of high school grades is less likely to be ranked higher, all things the same, when the entire sample of applicants is considered. However, when we restrict the sample to only high school students with a minimum average grade of 80%, a higher admission standard is regarded by them as a positive attribute of an institution.

The impacts of university rankings are puzzling for the larger institutions where a fall in rank produces a positive impact on the probability of being preferred by applicants. The results for smaller, primarily undergraduate universities are consistent with the notion that institutions benefit from an improvement in their rankings. We have argued that, in the case of these universities, potential applicants have a poorer

information set than is the case for large institutions and rely on the national university rankings to make their choices. But we unable to explain the outcome for the medical/doctoral institutions.

Ontario universities are more homogeneous than their American counterparts. Nevertheless, it is unreasonable to argue that the measures used in this analysis capture all differences that are relevant to the choices of prospective students. There are, for example, distinct characters and brands among the institutions which we cannot control for in our estimates. We must therefore acknowledge the possibility of simultaneity in our estimates. In particular, there may be some circularity in the relationship between the average entering grades of students and the desirability of institutions that has not been accounted for in our specification. We are also puzzled by the finding that larger institutions do better when they fall in the national university rankings and must be concerned that this is a spurious finding. Ideally, we would want to test the role that these rankings play by first differencing out unobservable characteristics of universities. This would require matching samples of applicants in two consecutive years and observing how choices respond to changes in rankings.

Nevertheless, we believe these results further both our knowledge of choices made by university applicants and the methodology by which these choices are examined. Our findings have, for example, some practical implications for institutional researchers and enrolment managers charged with the responsibility of marketing their institutions. This community generally understands that distance matters and and that students are attracted by scholarships, and these beliefs are confirmed by our results. What may be new here is that we are able to quantify the impact of these variables. Our estimates also produce more complex dynamics of student choice that may be less well understood by higher education practitioners. For example, the findings in this paper suggest that a successful marketing strategy for a university should emphasize instruction and de-emphasize research activity in order to attract undergraduates. Smaller universities that do well in the Maclean's rankings should advertise that success in its promotional literature while those that do not do well have cause for concern should that lack of success become widely known. Larger universities can ignore the national rankings one way or the other.

ACKNOWLEDGMENTS

We are indebted to the Ontario University Applications Centre and the Council of Ontario Universities for the provision of data used in

this paper. We would also like to thank two anonymous referees whose comments have added much to this paper. Any remaining errors are the sole responsibility of the authors.

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Received March 25, 2005.