The Effect of the Financial Aid Package on the Choice of a Selective College

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Abstract — This paper examines the effects of financial aid on the decision to attend a selective liberal arts college using data obtained from applicants accepted to Occidental College in 1989. Patterned after a similar empirical investigation by Ehrenberg and Sherman for accepted freshmen at Cornell in 1981, logit probabilities of enrollment equations are estimated based on (1) observable characteristics of the individual students, (2) the net costs of attending Occidental and the various alternative colleges under consideration (including the financial aid packages offered) and (3) other characteristics of these alternative colleges. The results, like Ehrenberg and Sherman's, indicate that relative tuition and scholarships affect the probability of enrollment for financial aid applicants, but that loans and work study assistance have no statistically significant effect. Non-financial aid applicants — a group not investigated by Ehrenberg and Sherman — are much less sensitive to relative cost considerations.

I. INTRODUCTION

THE 1980s WITNESSED many changes in the cost and financing of higher education in the United States. Adjusted for inflation, tuition at private 4-year colleges and universities increased by 47% (30% at public institutions). At the same time, student aid from all sources increased by only 10.5%, and disposable family income increased by only 16%. In addition, student loans carved a bigger niche in the total student aid picture during the 1980s, with loans rising from only 70% of grant spending in 1981, to 100% of grant spending in 1988 (College Board, 1989a).

Because of these changes, an updated look at the effect of financial aid on the choice of a college seems particularly useful. This paper attempts to provide such an update. It also represents an attempt to corroborate empirical work by Ehrenberg and Sherman (1984, referred to as Ehrenberg hereafter) who modelled and examined empirically the decision by financial aid applicants to enroll at Cornell for the class entering in 1981. We apply the Ehrenberg methodology to Occidental, a selective liberal arts college, for the class entering in 1989.[1]

Our key result is that tuition and scholarships affect the probability of enrollment of financial aid applicants, but that loans and work-study have no significant effect. We find that the implied elasticity of the probability of enrollment with respect to the "net price" at Occidental is −0.72, a bit lower than Ehrenberg's −1.09 for Cornell, but we also find that this elasticity is greater (in absolute terms) for financial aid applicants with larger family income, and for financial aid applicants who are white. Relative cost considerations play a much less important role in the decisions of non-financial aid applicants, a group that Ehrenberg did not examine at all. In Part II we briefly explain the model. Part III describes the data and presents the results for financial aid applicants, while Part IV presents the results for non-financial aid applicants. We present some conclusions in Part V.

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II. A MODEL OF THE CHOICE OF A SELECTIVE COLLEGE

Following Ehrenberg, we can model the decision to enroll at a given selective college by considering the choice of an applicant between one selective college and another.[2] Ehrenberg assumes that the applicant will compare the net utility of each option. He postulates that the net utility of each option depends upon three basic types of variables: (1) the observable characteristics of the individual; (2) the net costs to the applicant of the two options; and (3) other characteristics of the two options. In addition, the net utility also depends upon random variables representing unobservable differences in tastes of the individual. With some further assumptions about the random variables, we can represent this choice as a logit model.[3]

Using this basic framework, we obtain estimates of the determinants of the probability of enrollment for freshman applicants who were admitted to Occidental College for the academic year 1989–1990. The equation that is estimated in Section III took the following form.

The dependent variable was a dummy variable equal to 1 if the accepted applicant enrolled at Occidental, and 0 otherwise. The independent variables were grouped into three basic categories as follows.

(A) "Personal Characteristics" Variables

Academic rating — applicants at Occidental are given an academic rating which varies from 1 to 9, based on their SAT score, class rank and the rigor of their high school courses; 9 is the highest rating and 1 the lowest. (In our sample only a few students with scores as low as "4" were accepted.) From this rating, five dummy variables were created, with "academic rating = 6" arbitrarily omitted. Other institutional research has determined that this academic rating is a better predictor of performance at Occidental than any one of its components separately. However, we also used the more standard SAT score sum and class rank. Our results were not at all sensitive to these alternative measures of academic ability. Refer to footnote 8.

Gender — a dummy variable equal to 1 if applicant is male, 0 otherwise.

Race — a dummy variable equal to 1 if applicant is black or Latino.

Legacy — a dummy variable equal to 1 if applicant's parents, siblings or grandparents attended Occidental.

Region — seven dummy variables corresponding to the applicant's residence. One variable for each region, with California arbitrarily omitted.

Parental discretionary income — family income adjusted along the Uniform Methodology guidelines by the Occidental financial aid office. It adjusts AGI ("adjusted gross income") for such factors as the number of children in the family, home equity, savings, etc., and is best thought of as a measure of "ability to pay".

(B) "Cost Variables"

Three versions were estimated.

Version 1:

Net cost OVERALL = Occidental cost minus "alternative college" cost. (The cost in each case is tuition plus room and board minus the total amount of scholarships available at each college. The "alternative college" is the college the applicant would have attended if he or she were not attending Occidental, or the college the applicant is actually attending.)

Net loan = Total loans at Occidental minus total loans at "alternative".

Net work study = Total employment opportunities at Occidental minus total employment opportunities at "alternative".

Version 2

Occidental "net cost" = Tuition + room/board at Occidental minus scholarships at Occidental. (This is sometimes referred to as the "net price" of attending Occidental later in the paper.)

Alternative College "net cost" = Alternative tuition + room/board minus scholarships at alternative college.

Loans at Occidental.

Occidental employment opportunities.

Loans at "alternative college".

"Alternative college" employment opportunities.

Version 3

Similar to version 2 except that Occidental costs and scholarships at Occidental are entered separately, and similarly with alternative college costs and scholarships.

(C) Characteristics of Alternative College

Average Freshman SAT Total.

"Liberal arts college" — dummy equal to 1 if alternative is a liberal arts college.

Region of alternative (vs region of applicant) — two variables were used to capture this relationship: (1) a dummy variable equal to 1 if applicant lived in the same region as the location of her "alternative", and the region in question was not California; (2) a dummy equal to 1 if applicant lived in California, AND region of alternative college was not California.

The three versions — 1, 2 and 3 — differ in terms of how the cost and financial aid variables enter the estimating question. We originally hypothesized that the magnitude of each of these cost and scholarship coefficients was the same, i.e. a dollar of tuition had the same effect as (minus) a dollar of scholarship, and a dollar of tuition (or scholarship) at Occidental had the same effect but opposite sign of a dollar of tuition (or scholarship) at the alterntive college. This is represented by Version 1. Versions 2 and 3 relax this assumption in varying degrees. Version 2 allows the "net cost at Occidental" to have a different effect (in absolute terms) than the "net cost at the alternative college", and version 3 allows tuition (and room and board

dollars) to have a different effect (in absolute terms) than scholarship dollars. Similar adjustments apply to the effect of a dollar of loans, with Version 1 hypothesizing that only the difference in the magnitude mattered, and with the other versions entering the loan amount at Occidental and the loan amount at the alternative separately.

III. RESULTS FOR FINANCIAL AID APPLICANTS

The data required to estimate this model came from a variety of sources, including a questionnaire that we sent to all accepted Occidental freshmen for the class of 1993, as described in the accompanying footnote.[4] Since this study is primarily concerned with the effects of the financial aid package on college choice, all of our estimates in this section apply only to accepted students who applied for financial aid at Occidental. However, in the next section, we estimate a separate set of results for those accepted students who did not apply for financial aid, for comparison purposes. We also consciously planned ahead of time to estimate the three separate versions of the basic equation described in Part B.

Table 1 presents logit enrollment equations for financial aid applicants for the three versions of the basic model. A likelihood ratio test suggests that the overall model is a reasonable one for the choice of a college such as Occidental[5] (sometimes referred to as "Oxy" hereafter). The pattern of the results is quite similar to Ehrenberg although our *t*-values and sample size are lower. Of the many variables described in the previous section, the scholarship and cost variables at Oxy (and the alternative college) and the quality of the alternative college (as measured by their freshmen SAT scores) are the variables with the most significance in terms of *t*-values.

The coefficient on "net cost OVERALL" implies that a $1000 increase in this variable (either from an increase in Oxy tuition, a decrease in the alternative college tuition, a decrease in Oxy scholarship, or an increase in the alternative college scholarship) reduces the yield by 0.03. At Occidental, the average yield among financial aid applicants is 0.38. Thus, if the average Oxy scholarship were to decrease by $1000, the yield would fall to 0.35, or approximately 7.8% (0.03/0.38), *ceteris paribus*. Very similar results are implied by the coefficients

Table 1. Logit enrollment equations for the class of 1993 (admitted financial aid applicants only)*

Independent variables	Version 1		Version 2		Version 3	
	Coeff.	∂ Commit/∂X	Coeff.	∂ Commit/∂X	Coeff.	∂ Commit/∂X
Academic rating = 4	1.88	0.45	2.01	0.48	2.03	0.48
	(1.9)		(2.0)		(2.0)	
Academic rating = 5	0.42	0.10	0.61	0.14	0.62	0.14
	(1.4)		(1.8)		(1.8)	
Academic rating = 7	−0.11	−0.03	−0.20	−0.05	−0.21	−0.05
	(0.36)		(0.6)		(0.6)	
Academic rating = 8	0.39	0.09	0.32	−0.08	0.32	−0.08
	(0.9)		(0.7)		(0.7)	
Academic rating = 9	0.34	0.08	0.35	0.08	0.42	0.10
	(0.4)		(0.4)		(0.4)	
Gender (Male = 1)	−0.61	−0.14	−0.12	−0.03	−0.13	−0.03
	(0.3)		(0.5)		(0.5)	
Race (Black/Latino = 1)	0.03	0.01	−0.21	−0.05	−0.24	−0.06
	(0.09)		(0.4)		(0.5)	
Legacy (Legacy = 1)	0.16	0.04	−0.05	−0.01	−0.07	−0.02
	(0.3)		(0.1)		(0.2)	
Parental income (in $10,000)	−0.07	−0.02	−0.018	−0.004	−0.02	−0.005
	(1.7)		(0.4)		(0.4)	
Region = New England	0.25	0.06	0.31	0.07	0.38	0.09
	(0.5)		(0.6)		(0.7)	
Region = Mid-Atlantic	−0.28	−0.07	−0.20	−0.05	−0.13	−0.03
	(0.48)		(0.3)		(0.2)	
Region = South	−0.18	−0.04	−0.07	−0.02	0.05	−0.01
	(0.2)		(0.1)		(0.0)	
Region = Midwest	−0.42	−0.10	−0.38	−0.05	−0.31	−0.07
	(0.8)		(0.7)		(0.6)	
Region = Rocky Mountain	1.38	0.33	1.47	0.35	1.48	0.35
	(2.2)		(2.3)		(2.3)	
Region = Pacific	−0.37	−0.09	−0.32	−0.08	−0.29	−0.07
	(1.0)		(0.9)		(0.8)	
Region = Southwest	0.05	0.01	0.09	0.02	0.14	0.03
	(0.1)		(0.2)		(0.3)	
Net cost OVERALL [(Oxy cost − grants at Oxy) − (alter. cost − grants at alter.) in $1000]	−0.11 (4.2)	−0.026	—			
Net cost Oxy (Oxy cost − grants at Oxy in $1000)			−0.130 (3.9)	−0.031		
Net cost alter. (alter. cost − grants, in $1000)			0.073 (2.3)			
Grants at Oxy (in $1000)			—		0.13 (3.9)	0.031
Grants in alter. (in $1000)			—		−0.08 (2.3)	−0.02
Net loan [(loans at Oxy − loans at alter.) in $1000]	−0.00002 (0.0)	0.000	—			
Net work study [(Oxy − alter., in $1000)]	−0.19 (1.1)	−0.045	—			
Loans at Oxy (in $1000)			−0.179 (1.4)	−0.04	−0.18 (1.4)	−0.04
Loans at alter. (in $1000)			−0.029 (0.4)	−0.01	−0.02 (0.3)	0.00
Work study at Oxy (in $1000)			0.187 (0.6)	0.04	0.17 (0.5)	0.04
Work study at alter. (in $1000)			0.310 (1.5)	0.07	0.34 (1.6)	0.08

Table 1 — *continued*

Independent variables	Version 1		Version 2		Version 3	
	Coeff.	∂ Commit/∂X	Coeff.	∂ Commit/∂X	Coeff.	∂ Commit/∂X
Alternative cost (in $1000)					0.06 (1.3)	0.01
Alternative SAT sum (in 100)	−0.70 (5.3)	−0.17	−0.69 (5.2)	−0.09	−0.66 (4.8)	−0.16
Liberal arts dummy	0.18 (0.7)	0.04	0.22 (0.8)	0.05	0.33 (1.0)	0.08
[Region = Region of alter., and not Calif.]	0.22 (0.63)	0.05	0.15 (0.4)	0.04	0.10 (0.3)	0.02
[Region = Calif. and alter., not Calif.]	−0.96 (1.65)	−0.23	−0.91 (1.6)	0.22	−0.85 (1.5)	0.20
Constant	7.8		7.7		5.5	
Log likelihood	−222.4		−219.2		−218.9	
n	403		403		403	

Note: Numbers in parentheses are *t*-ratios.
*Dependent variable = 1 if attending Occidental; 0 otherwise.

on the "net cost Oxy" (net price) or "grants at Oxy" variables and in this sense the three versions shown in the table are quite similar. The implied elasticity of the probability of enrollment with respect to the "net cost at Oxy" (net price) is approximately −0.72, compared with −1.09 in Ehrenberg.[6]

Relative to scholarships, the coefficients of the variables that attempt to measure the effects of loans on the decision to enroll have much lower *t*-values (all of which are insignificantly different from zero). The coefficient on "work study" was also not significantly different from zero. In Versions 2 and 3, the coefficients on the "alternative college" costs and scholarship aid were a bit smaller in magnitude than the similar coefficents for Occidental costs and scholarship aid.

Ehrenberg found that minority students at Cornell were less likely to enroll, *ceteris paribus*, and applicants with alumni relatives more likely to enroll. The point estimates in our study have the same signs, but these variables are not significantly different from zero. It is also worth noting that some of the coefficients of the dummy variables representing the region of residence of the applicant are significant, but the location of the alternative college relative to the applicant's region of residence is not a significant factor.

In our study, the higher the parental income (again, among financial aid applicants only), the lower the probability of attending Occidental, and this variable is statistically different from zero at the

10% level in Version 1. In Ehrenberg, the *t*-value of this coefficient was 0.3 (or 0.8 in another specification), but the point estimate was "positive" in sign, consistent with what most economists would expect.[7]

How sensitive are these results to the specification chosen? The estimated coefficients on the financial aid and cost variables are not at all sensitive to (1) additional variables that we proposed prior to observing any of the empirical results, (2) alternative measures of some of the variables, or (3) the functional form of the basic equation.[8]

Of special interest is the sensitivity of specific applicant groups' probability of enrollment with respect to Occidental's "net price" (Occidental expenses minus scholarships available at Occidental). The groups we selected for this purpose varied by race, parental income and the academic ability of the student. As Ehrenberg discussed, such elasticities can first be computed using the different *means* for "net price" and "probability of enrollment" of the various groups, assuming the *coefficient* on the net price variable is the same for different groups. These results are shown in column 1, Table 2. Contrary to the more usual empirical finding that lower family income applicants are more price sensitive, those financial aid applicants with higher family income have larger net price elasticities. A similar result was obtained by Ehrenberg, and the discussion there is consistent with the data here as well. Such a result is not due, it turns

Table 2. Implied elasticities of the probability of enrollment with respect to Occidental's net price
(Financial aid applicants only)

	Elasticity	
Characteristics of group in questions	Column 1 (using same coefficient but different means)	Column 2 (allowing for different coefficients)
Parental income		
0–$10,000	−0.19	
10,000–20,000	−0.12	
20,000–30,000	−0.29	−0.29*
30,000–40,000	−0.29	
40,000–50,000	−0.90	
50,000–60,000	−0.68	
60,000–70,000	−1.62	
70,000–80,000	−2.87	−0.83
Over 80,000	−1.46	
Academic rating		
Academic rating = 4	−0.15	−0.04
Academic rating = 5	−0.54	−0.56
Academic rating = 6	−0.83	−0.61
Academic rating = 7	−0.88	−1.16
Academic rating = 8	−0.72	−0.72
Academic rating = 9	−0.68	−1.89
Race		
White	−0.87	−0.64
Minority (Black/Latino)	−0.18	−0.26
Overall	−0.72	

Explanation: Column 1 results use the coefficient on "net price Oxy" in Table 1, version 2, and the mean values of the relevant variables for each subsample. Column 2 uses these same mean values of the relevant variables for each subsample but allows each subsample to have a different coefficient on "Oxy net price" variable through the use of additional "interaction terms" of the form [(Occidental net price) × (subsample dummy variable)]. For illustration purposes, the coefficient on "Oxy net price" alone when all the interaction terms were included in the equation was −0.0947. For the subsample of race, the coefficient on the interaction term [(Oxy net price) × dummy variable minority = 1] was −0.0873. Thus, to compute the elasticity that appears for "White" in column 2 we first multiplied −0.0947 × (0.237) to convert the logit coefficient to ∂Commit/∂Net price for whites. This number must then be multiplied by the mean value for whites for the "net price" at Oxy (= $10,174) and divided by the mean value for whites for the probability of enrolling at Oxy (= 0.358). For minorities, the procedure was to multiply [(−0.0947+ −0.0873) × (0.237)] by the mean value of minorities for the "net price" at Oxy, divided by the mean value of minorities for the probability of enrolling at Oxy. In column 1, the elasticity for white uses the mean values for whites as above, but uses the coefficient on net price Oxy from Table 1, version 2, i.e. −0.129. The column 1 value for minorities also uses this same coefficient (−0.129), but mean values for minorities.
  *Interaction term used dummy variable = 1 if parental income was $60,000 or over.

out, to the possible conjecture that higher income students might have a higher quality alternative option. For the students in this study, as at Cornell, this simply is not the case. However, it may be due to the fact that Occidental tended to provide relatively more aid to lower income students (and relatively less to higher income students) than its competitors, as also was the case at Cornell.[9]

The implied elasticity of enrollment to Occidental's net price does not vary much by academic rating in our results. Ehrenberg, on the other hand, found the elasticity to be higher the higher the SATs of Cornell applicants.[10]

The implied elasticity of enrollment to net price is much lower for minorities than for whites in our results. This could be a result of a variety of special

circumstances at Occidental, including a black president and a multicultural summer institute. A similar pattern was observed at Cornell. Another possibility is that given a similar coefficient, the mean values for whites for "net cost" and "probability of enrollment" result in a point further northwest on the same linear demand curve. Thus, whites have a larger net price elasticity.[11]

It is also possible to compute the implied elasticity of the probability of enrollment with respect to the "net price at Oxy" for the different groups in Table 2, by allowing the *coefficient* in the logit equation to vary by group status. Such elasticities are shown in the second column of Table 2, and are included largely for comparison purposes with Ehrenberg. (Consult the table for a fuller explanation.) The probability of enrollment equations with such interaction terms are available from the authors. It is important to note that since none of these interaction term coefficients has a significant *t*-value, we feel that more attention should be placed on the elasticities in column 1.

IV. RESULTS FOR NON-FINANCIAL AID APPLICANTS

The logit probability of enrollment equations that we estimated to produce the results reported in Tables 1 and 2 were also estimated for the group of students who did not apply for financial aid. We did not have parental income for this group of students, but the key results in the previous section were not

sensitive to the omission of this variable.[12] As a result, we concluded that it would be useful to determine how the results differed for this group of students. Tables 3 and 4 display these results in a fashion directly analogous to the results in Tables 1 and 2.[13]

The implied "net price" elasticities are generally much lower for the non-financial aid applicants, with an "overall" elasticity of -0.35, compared with -0.72 for financial aid applicants. Further, the *t*-values for the cost and financial aid coefficients are much lower.[14]

The pattern of the net price elasticities by subsample also changes, with minorities now having the same net price elasticity as whites, and those with higher academic ratings generally being more price sensitive. It is not possible to compute net price elasticities by family income since this variable is not available for non-financial aid applicants.

Non-financial aid applicants' coefficients for race, legacy, liberal arts college status and academic rating all had *t*-values above 1.7, while these coefficents were not statistically significant for the financial aid applicants in the results in Part III.[15]

V. CONCLUSIONS

While the financial aid and cost picture in higher education has been altered drastically in the 1980s, the effect of cost and the financial aid package on the decision to enroll in a selective liberal arts college in 1989 appears to work about as it did in

Table 3. Logit enrollment equations for the class of 1993 (non-financial aid applicants only)*

Independent variables	Version 1		Version 2		Version 3	
	Coeff.	∂ Commit/∂X	Coeff.	∂ Commit/∂X	Coeff.	∂ Commit/∂X
Academic rating = 4	2.68	0.56	2.32	0.55	2.64	0.63
	(2.0)		(1.7)		(1.9)	
Academic rating = 5	0.57	0.12	0.59	0.12	0.59	0.12
	(2.2)		(2.2)		(2.2)	
Academic rating = 7	−0.89	−0.19	−0.88	−0.19	−0.90	−0.19
	(2.3)		(2.2)		(2.3)	
Academic rating = 8	−1.80	−0.37	−1.92	−0.40	−1.87	−0.39
	(2.4)		(2.4)		(2.4)	
Academic rating = 9	−0.44	−0.09	−0.41	−0.09	−0.23	−0.05
	(0.4)		(0.4)		(0.2)	
Gender (Male = 1)	−0.04	−0.01	−0.04	−0.01	−0.01	−0.00
	(0.1)		(0.2)		(0.2)	
Race (Black/Latino = 1)	−1.02	−0.21	−0.87	−0.18	−0.98	−0.20
	(1.7)		(1.4)		(1.5)	
Legacy (Legacy = 1)	0.71	0.15	0.71	0.15	0.75	0.16
	(1.7)		(1.7)		(1.7)	

Table 3 — *continued*

Independent variables	Version 1 Coeff.	Version 1 ∂ Commit/∂X	Version 2 Coeff.	Version 2 ∂ Commit/∂X	Version 3 Coeff.	Version 3 ∂ Commit/∂X
Parental income (in $10,000)						
Region = New England	0.62	0.13	0.60	0.12	0.79	0.16
	(1.4)		(1.4)		(1.7)	
Region = Mid-Atlantic	0.25	0.05	0.25	0.05	0.34	0.07
	(0.7)		(0.7)		(0.9)	
Region = South	−0.31	−0.06	−0.22	−0.04	−0.21	−0.04
	(0.3)		(0.2)		(0.2)	
Region = Midwest	1.09	0.23	1.09	0.23	1.20	0.25
	(2.2)		(2.2)		(2.4)	
Region = Rocky Mountain	0.42	0.09	0.41	0.09	0.59	0.12
	(0.8)		(0.7)		(1.0)	
Region = Pacific	0.39	0.08	0.36	0.07	0.64	0.13
	(1.0)		(0.9)		(1.5)	
Region = Southwest	0.92	0.19	0.91	0.19	1.08	0.22
	(1.8)		(1.8)		(2.0)	
Net cost OVERALL	−0.036	−0.007				
[(Oxy cost − grants at Oxy) − (alter. cost − grants at alter.) in $1000]	(1.2)		—			
Net cost Oxy (Oxy cost − grants at Oxy in $1000)			−0.031	−0.006		
			(0.3)			
Net cost alter. (alter. cost − grants, in $1000)			−0.039	−0.008		
			(1.3)			
Grants at Oxy (in $1000)			—		0.04	0.01
					(0.5)	
Grants in alter. (in $1000)			—		−0.023	0.00
					(0.4)	
Net loan [(loans at Oxy − loans at alter.) in $1000]	−0.080	−0.02	—			
	(0.5)					
Net work study [(Oxy − alter.) in $1000)]	−0.001	0.00	—			
	(0.0)					
Loans at Oxy (in $1000)			−0.79	−0.16	−0.77	−0.16
			(1.2)		(1.1)	
Loans at alter. (in $1000)			−0.011	0.00	0.054	0.01
			(0.1)		(0.3)	
Work study at Oxy (in $1000)			1.11	0.23	1.15	0.24
			(0.6)		(0.7)	
Work study at alter. (in $1000)			−0.007	0.00	−0.005	0.00
			(0.2)		(0.2)	
Alternative cost (in $1000)					−0.068	−0.01
					(1.8)	
Alternative SAT sum (in 100)	−0.59	−0.12	−0.59	−0.12	−0.56	−0.12
	(4.0)		(3.9)		(3.6)	
Liberal arts dummy	0.89	0.19	0.91	0.19	0.99	0.21
	(3.2)		(3.2)		(3.4)	
[Region = Region of alter., and not Calif.]	−0.43	−0.09	−0.44	−0.09	−0.46	−0.10
	(1.1)		(1.2)		(1.2)	
[Region = Calif. and alter., not Calif.]	−0.14	−0.03	−0.19	−0.04	−0.11	−0.02
	(0.4)		(0.4)		(0.2)	
Constant	5.1		6.4		5.66	
Log likelihood	−224.2		−223.2		−222.4	
n	447		447		447	

* Dependent variable = 1 if attending Occidental; 0 otherwise.

Table 4. Implied elasticities of the probability of enroll-
ment with respect to Occidental's net price (non-financial
aid applicants only)

Characteristics of group in questions	Elasticity
Parental income	
0–$10,000	(Not applicable since no
10,000–20,000	parental income available for
20,000–30,000	non-financial aid applicants)
30,000–40,000	
40,000–50,000	
50,000–60,000	
60,000–70,000	
70,000–80,000	
Over 80,000	
Academic rating	
Academic rating = 4	−0.19
Academic rating = 5	−0.21
Academic rating = 6	−0.23
Academic rating = 7	−0.32
Academic rating = 8	−0.46
Academic rating = 9	−0.33
Race	
White	−0.35
Black/Latino	−0.35
Overall	−0.35

1981 for Cornell applicants. Tuition (and room and board) costs definitely affect the enrollment decisions of financial aid applicants, as does the amount of scholarships. Loans and work-study opportunities play a much less important role, *ceteris paribus*. Also of key importance is the quality of the alternative choice, as measured by the SATs of the entering freshmen, and the costs and financial aid package offered there. Non-financial aid appli-

cants — a group not examined by Ehrenberg — are much less sensitive to relative cost considerations.

However, some of our findings differ from Ehrenberg. Parental income negatively affects the decision to enroll at Occidental in a marginally statistically significant manner. Further, unlike the results at Cornell, academic ability, race and legacy are not significant for Occidental financial aid applicants.

In terms of the quantitative effects of scholarships and tuition on the decision to enroll, this study finds that a $1000 increase in tuition (or equivalently, a $1000 decrease in scholarship), reduces the yield by 0.03, say from a mean of 0.38 to 0.35. Overall, the implied elasticity of the probability of enrollment with respect to the "net price" of the college for financial aid applicants is approximately −0.72. But this elasticity is larger (in absolute magnitude) for whites and for those with higher parental income, a somewhat surprising result first reported in Ehrenberg.

Such results, of course, have direct implications for the optimal financial aid policies at Cornell and at Occidental (and any other institutions with similar financial aid situations), the key focus of the Ehrenberg paper.[16] Of more importance here, the results suggest at least one broader implication for higher education in the 1990s. Assuming that the overall demand for higher education does not shift, and that the trend at the federal level towards the substitution of loans for grants continues, we can expect increasing pressure on private colleges to provide more scholarship aid. Not only was "net price" important in the decision of Cornell applicants in 1981 and Occidental applicants in 1989, but loans were not viewed as good substitutes for scholarship grants in the eyes of both groups.

NOTES

1. A good summary of the empirical studies to date on the effect of financial aid on college going is provided in Leslie and Brinkman (1988). Manski and Wise (1983) is the most cited study, but only Miller (1981) is institutionally based. We are not aware of any institutionally based studies that have been published since Ehrenberg, nor are we aware of any that have explicitly tried to use his methodology and corroborate his results.
2. Selective in this study simply means that there are a sufficient number of qualified applicants so that the college is able to select both the ones to accept and the type of financial aid package to offer each admitted applicant. At Occidental, slightly less than half the applicant pool is offered admission.
3. See Ehrenberg and Sherman (1984), p. 212, especially footnote 12. A better framework would be a behavioral model where the individual is considering several alternative colleges, instead of two. The logit model could still be applied. The only thing preventing such a multinomial model here is data limitations.

4. The data on personal characteristics came from our admissions data file. The data on the alternative college characteristics, including the tuition, room and board costs, and descriptive characteristics came from the 1988–1989 College Board Handbook. Data on the student's Occidental financial aid package and parental income came from our financial aid office data file. But the data on the "alternative college" financial aid package came from the results of a questionnaire that we administered to all accepted applicants to Occidental. For those accepting our offer of admission, we asked the name and financial aid package at the college they "would most likely have gone to, if not Occidental". For those refusing our offer, we asked the name and financial aid package at the college they were planning on attending in the Fall.

The percentage of applicants who responded to our questionnaire was 85% for those coming to Occidental and 65% for those going elsewhere. This suggests a sample selection problem that could result in inconsistent parameter estimates, which we have not attempted to deal with here. Approximately 100 of the 950 questionnaires returned were not usable primarily due to missing information about the alternative college's financial aid package. Another difficulty with our procedure is that we have asked for the "second choice" for those students who are attending Occidental, but we have no confidence that those who turned Occidental down viewed us as their "second choice". This asymmetry also appears to be a problem in Ehrenberg. The solution would be to model college choice in a multinomial logit framework. In order to achieve a high return rate, we only asked for information about one other financial aid offer. In inquiring about the financial aid package, we asked for the total dollar amount of scholarships, the total dollar amount of loans and total dollar amount of work-study opportunities, and made no attempt to distinguish between loans with different terms and conditions. Obviously an interest-free loan provides much more "subsidy" than a loan at market rates, but such distinctions were not made here.

5. The chi-square test statistic ranged from 93 to 97 for the three versions, indicating we could reject the null hypothesis that coefficients were all zero. Our basic equation (Version 1) predicts "correctly" for 73% of the students in the sample. That is, our equation predicts a probability of less than 0.5 for the students who reject Oxy and a probability greater than 0.5 for the students who accept, for 73% of the sample.

6. This elasticity is computed using the mean values of the probability of enrollment and "net cost at Oxy".

7. One possible conjecture for this result is that applicants with higher parental income apply to more colleges than the very needy financial aid applicants. This reduces the likelihood that the former will choose Occidental.

8. When we used class rank (percentile) and the SAT sum in place of the "academic rating" dummy variables, the coefficient on "net cost overall" was -0.11 (t-value equal to 3.9). Both entered negatively, as in Ehrenberg, with t-values of -1.0 and -1.3, respectively. In Version 2, the coefficient on "Net Price Oxy" was -0.134 ($t = 3.6$). Alternative variables to describe the "alternative college" also had virtually no effect on the magnitude of the coefficient on "net cost OVERALL" (or net price Oxy). Such variables included whether the college had an undergraduate major in business or engineering, and whether the college was a University of California campus. None of these dummy variables had coefficients that were significantly different from zero. Further, when parental income was omitted from the equation, the coefficient on "net cost OVERALL" was -0.127 (t-value equal to -5.23).

9. See Ehrenberg, footnote 19, for a fuller discussion.

10. As explained in footnote 8, the coefficient on "net price Oxy" is not sensitive to the measurement of academic ability, so these results are comparable.

11. Indeed, the results in the next section are consistent with such an explanation. When only those applicants without financial aid are considered, the net price elasticity does not vary by race.

12. See the last sentence of footnote 8.

13. Given the insignificance of the cost and financial aid variables for this group, analogous elasticity estimates to those in Table 2, column 2 were not computed.

14. Even though these students did not apply for financial aid from Occidental, they could still receive scholarships, either merit awards at Occidental and/or the alternative college, merit awards from outside sources, or financial aid awards from the alternative college. In general, the amount of observed scholarships to non-financial aid applicants was very small, although it is conceivable that some of these scholarships would not be recorded in Occidental's financial aid files. This is another reason we separated our sample by financial aid application status.

15. Version 2 was also run with a combined sample of applicants and non-applicants for financial aid. Since we were missing parental income for the latter group, a dummy variable was added, indicating whether the student had applied for financial aid. This dummy was also interacted with the "net price Oxy" variable. The coefficient for "net cost Oxy" was -0.14 ($t = -6.2$), and the alternative college SATs, academic rating dummies, race and liberal arts dummy all had t-values greater than 1.7. The

coefficient on the interaction term was 0.11 ($t = 3.6$), indicating that the net coefficient on "Net Price Oxy" for non-financial aid applicants was 0.03. This last value is the same as the coefficient on "net price Oxy" in Table 3. Finally, the coefficient on the dummy variable for financial aid application status was -1.7 ($t = -1.5$), and indicated that those who do not apply for financial aid are less likely to attend Occidental, *ceteris paribus*. The complete results of this "combined sample" estimation are available from the authors upon request.

16. Ehrenberg's theoretical results suggested that financial aid packages should be more generous (1) for groups that the university considered relatively more attractive, (2) for groups that have lower propensities to enroll (controlling for other factors affecting enrollment), (3) for groups that have higher elasticities of the probability of enrollment (yield) with respect to the university's share of costs and (4) for groups with higher (in absolute value) elasticities of average quality with respect to the number of applicants admitted. The results in our study bear directly on items 2 and 3 in this list. Two conclusions emerge. First, the case for even more emphasis on "academic merit" than under current policy at Occidental is not strong — the elasticity of the probability of enrollment with respect to net price does not vary by academic ability, and the propensity to enroll (at any price) is not systematically lower for higher academic ability applicants. Second, there is some evidence to imply that the amount of aid to lower parental income aid applicants is now too generous relative to higher income aid applicants. As in Ehrenberg, the elasticity of the probability of enrollment with respect to net price is higher for higher parental income applicants. But in addition, the propensity to enroll (at any price) is higher for lower (parental) income applicants at Occidental. It was neutral in this respect in Ehrenberg.

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