Does It Pay to Attend an Elite Private College? Evidence on the Effects of Undergraduate College Quality on Graduate School Attendance

ERIC EIDE,*§ DOMINIC J. BREWER† and RONALD G. EHRENBERG‡

*Department of Economics, 182 FOB, Brigham Young University, Provo, UT 84602-2363, USA
†RAND Corporation, 1700 Main Street, Santa Monica, CA 90407, USA
‡Cornell University, New York State School of Industrial and Labor Relations, 256 Ives Hall, Ithaca, NY 14853-3901, USA and the National Bureau of Economic Research.

Abstract—Much attention has recently focused on the rapidly rising costs of a college education, and whether the benefits of attending an elite private college have kept pace with the increasing costs. In this paper we analyze whether undergraduate college quality affects the likelihood that an individual attends graduate school. Using data on three cohorts of students from the *National Longitudinal Study of the High School Class of 1972* and *High School and Beyond*, we find that on balance attendance at an elite private college significantly increases the probability of attending graduate school, and more specifically, graduate school at a major research institution. [*JEL* I21, J24] © 1998 Elsevier Science Ltd. All rights reserved

1. INTRODUCTION

THE COST of a college education has been rapidly rising in recent years, growing nearly two and a half times faster than the cost of living since the early 1980s. This has been concentrated among the most selective private institutions, exacerbating the substantial price differential for elite private schools relative to other private and public institutions. For example, the average cost of attending an elite private college or university is about $1000 a week, while the average cost across all private colleges and universities is about $630 a week, and the average cost of attending a public college or university is only around $250 a week (Morganthau and Nayyar, 1996).[1] As students and policy makers work to finance the escalating costs of attending these elite private institutions, a natural question arises: have the benefits of attending an elite private college been keeping pace with the increasing costs?

Recent academic research has addressed one part of this question, namely whether students attending elite private institutions receive higher labor market earnings to compensate them for the higher tuition costs (Behrman *et al*., 1995; Brewer and Ehrenberg, 1996; Brewer *et al*., 1996; Daniel *et al*., 1995; Loury and Garman, 1995). Most of this work finds a statistically significant labor market payoff to attending higher quality undergraduate colleges. Brewer *et al*.,

1996, in a paper which attempted to control for sample selection and utilized data on multiple cohorts of students, found that the annual earnings premium to attending the most selective private institutions has been rising over time, from 15 percent in 1986 for those about 10 years from college, to 37 percent in 1992 for those about 6 years after college. This finding is consistent with a growing body of work on the labor market returns to college more generally which has suggested a rising premium to college attendance (Bound and Johnson, 1992; Grogger and Eide, 1995; Katz and Murphy, 1992), and suggests concerns about the increasing cost of college at the premier colleges and universities may be misplaced.

Previous studies have used post-college undergraduate earnings about six to ten years out to measure college quality premia, but have ignored the effect of attending an elite private college on graduate school attendance.[2] To the extent that elite private institutions enhance graduate school attendance, they will reduce the time individuals have been in the labor market thus leading these studies to understate the long-run impact of attendance at an elite private institution on earnings. Furthermore, graduate school is an integral part of an individual's human capital accumulation, and often is a necessary step in accessing a desired career path (e.g. physician, lawyer, or professor). Indeed, since an undergraduate degree is prerequisite to graduate study, many stu-

dents likely attend college because of the "option value" for further graduate study it provides, and not necessarily for the labor market returns to the undergraduate degree (Eide and Waehrer, 1998). Hence, simply analyzing the labor market premium associated with different college quality types may underestimate the "true" advantage to attending more selective (more expensive) private undergraduate institutions, and also ignores the *mechanism* through which undergraduate college quality affects earnings via the effect on final education level. If higher quality colleges lead to a higher probability of graduate school attendance, then these findings would provide further justification for attending a more expensive elite private college in the presence of dramatically increasing tuition costs and the availability of lower cost public institutions.

In this paper we estimate the effect of undergraduate college quality on the probability of graduate school attendance. We use three cohorts of students (high school classes of 1972, 1980, and 1982) to provide a broad range of estimates of how the undergraduate college quality–graduate school relationship has changed across cohorts of students over time. We find that on balance attendance at an elite private college significantly increases the probability of attending graduate school, and more specifically, attending graduate school at a major research institution. These results are strongest among the 1972 and 1980 cohorts.

2. DATA

To obtain estimates of the effect of college quality on graduate school attendance, we employ nationally representative data sets collected by the National Center for Education Statistics (NCES): *The National Longitudinal Study of the High School Class of 1972* (NLS72) and the *High School and Beyond* (HSB). These data contain detailed individual, family and schooling characteristics for three cohorts of students: approximately 21,000 who graduated high school in 1972, and more than 10,000 students who graduated high school in 1980, and in 1982 (1980 high school sophomores). Information pertaining to undergraduate college and graduate school attendance, as well as a variety of labor market outcomes, was collected in a series of subsequent surveys.

Throughout our analyses, we employ a six-fold classification of college quality type, derived from various editions of Barron's *Profiles of American Colleges*. These ratings are based primarily on the selectivity of admission decisions. We divide institutions into three groups based on a rating of most competitive or highly competitive ("top" or "elite"), very competitive or competitive ("middle"), and less competitive or noncompetitive ("bottom"). We distinguish between privately and publicly controlled institutions in each category, based on information in the *Higher Education General Information Survey* (HEGIS). For

those who attended graduate school, we used the Carnegie Classification system to determine whether the graduate program in which the student was enrolled was rated as a major research institution (Research I or Research II (R1/R2)) or not.[3]

We utilize the three cohort samples from NLS72 and HSB, which allows us to assess how the college quality–graduate school attendance relationship has changed across cohorts of students from the 1970s and 1980s. We restrict our sample to students who attended a four-year Barron's rated college upon completion of high school. For the 1972 cohort, we use information from the fourth (1979) and fifth (1986) follow-ups to determine whether the students ever attended graduate school; for the 1980 and 1982 cohorts we use data from the third (1986) follow-up and restricted fourth (1992) follow-ups to ascertain graduate school attendance. After eliminating missing values and merging all necessary data our sample sizes are a maximum of 3101 for the 1972 cohort, 2754 for the 1980 cohort, and 2403 for the 1982 cohort.

We present descriptive statistics for our nationally representative 1972 and 1982 cohort samples in Table 1, which shows various student characteristics separated by college quality type and sector.[4]

The fraction of females and males in our samples is roughly the same at each type of institution, with the exception of top publics where females comprise only 26 percent of students for the 1972 cohort and 32 percent for the 1982 cohort.[5] There were cross-cohort increases in the fraction of Hispanic and black students in each college quality type and sector (except bottom privates). Within a sector type and cohort, students from higher quality schools tended to come from families with greater incomes and better educated parents, with students from top private schools coming from the wealthiest and best educated families overall.

3. ESTIMATING FRAMEWORK

The goal of this paper is to examine the relationship between undergraduate college quality and graduate school attendance. Our investigation is based on two empirical models. We first estimate the probability of graduate school attendance as a function of individual characteristics (X) and a set of college quality indicators corresponding to each of our college quality/sector types (Z) (omitted category is bottom publics):[6]

$$G_i = \beta X_i + \gamma Z_i + \epsilon_i \qquad (1)$$

where $G_i = 1$ if the ith individual attends graduate school, and $G_i = 0$ otherwise.[7] Assuming the error term in Equation (1) is normally distributed, we estimate the parameters of Equation (1) with a standard probit model. The estimated probit marginal effects for the college quality dummies show how attending

Table 1. Student characteristics by college quality and college sector, 1972 high school seniors and 1982 high school seniors

	Top		Middle		Bottom	
	1972	1982	1972	1982	1972	1982
Private						
Female	0.43	0.47	0.50	0.54	0.54	0.55
Hispanic	0.00	0.08	0.01	0.16	0.01	0.18
Black	0.06	0.14	0.03	0.14	0.20	0.18
Family income	18,417	40,237	15,546	35,967	11,862	33,482
Father's education	15.50	13.56	14.12	13.51	11.60	13.55
Mother's education	14.74	14.98	13.33	13.58	12.66	13.19
Public						
Female	0.26	0.32	0.51	0.52	0.53	0.50
Hispanic	0.03	0.08	0.01	0.18	0.03	0.15
Black	0.07	0.13	0.03	0.16	0.11	0.15
Family income	15,628	43,386	14,730	33,548	12,541	30,194
Father's education	13.64	16.12	13.43	12.60	12.09	12.33
Mother's education	14.43	14.77	12.83	13.65	11.92	12.99

Figures are weighted to be nationally representative using sample weights provided by NCES.

each college quality type affects the probability of attending graduate school, relative to attending a bottom public school. This approach establishes baseline estimates of the undergraduate college quality–graduate school relationship.

In addition to determining the effect of college quality on graduate school attendance, it is of interest whether college quality affects the *type* of graduate school attended, since the more prestigious research universities likely provide students with higher quality resources (e.g. faculty, peers, and alumni networks), and may lead to better jobs and higher lifetime earnings. In our second empirical model, we estimate how undergraduate college quality affects the likelihood of attending graduate school at a major research university (Carnegie Classification of R1/R2), attending graduate school at another type of institution (non-R1/R2), or not attending graduate school.

In this model, we assume that an individual chooses among the three outcomes to maximize lifetime utility. We assume that utility (I) for the ith student is a function of individual characteristics (X), the college quality indicators (Z), and an error term:

$$I_{ij} = X_i\alpha_j + Z_i\delta_j + u_{ij} \qquad (2)$$

The ith individual chooses outcome j ($j = 1,2,3$) if $I_{ij} > I_{ik}$ for all k not equal to j. We can write the individual's decision as the log of the ratio of the probabilities of any two of the outcomes as:

$$\ln\left(\frac{P_{ij}}{P_{ik}}\right) = (\alpha_j - \alpha_k)X_i + (\delta_j - \delta_k)Z_i \qquad (3)$$

Empirical estimates of Equation (3) are obtained from the multinomial logit model, and the estimated logit coefficients show how attending undergraduate institutions of varying quality affect the log odds of attending graduate schools of varying quality (non-R1/R2 versus R1/R2), relative to no graduate school attendance. Taken together, the estimates from these models detail a broad picture of how undergraduate college quality affects graduate school attendance, including the type of graduate school attended.[8]

4. RESULTS

4.1. Effect of Undergraduate College Quality on the Probability of Graduate School Attendance

We first estimate probit marginal effects of the impact of undergraduate college quality on the probability of graduate school attendance, and report the results in Table 2. Columns (2.1), (2.3), and (2.5) represent estimates based on our sample of four-year college attendees without controlling for final educational attainment, while in columns (2.2), (2.4), and (2.6) we include a dummy variable indicating whether the respondent held a bachelor's degree or higher as of the survey date.[9]

A consistent finding across each specification in Table 2 is that attending a top private college has a positive and statistically significant effect on the probability of graduate school attendance. When final education level is added (columns (2.2), (2.4), and (2.6)) the magnitude of the top private coefficient falls in each case, indicating that part of the return to top privates in columns (2.1), (2.3), and (2.5) reflects degree completion; however, even after controlling for

Table 2. Estimated probit marginal effects of undergraduate college quality on the probability of graduate school attendance (absolute value *t* statistics)

	1972 Cohort (in 1986)		1980 Cohort (in 1986)		1982 Cohort (in 1992)	
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)
Top private	0.152 (3.0)	0.118 (2.3)	0.064 (3.2)	0.048 (2.6)	0.142 (3.7)	0.054 (1.9)
Middle private	0.028 (1.0)	−0.006 (0.2)	0.033 (2.4)	0.022 (1.7)	0.077 (2.9)	0.018 (0.9)
Bottom private	−0.012 (0.3)	−0.031 (0.6)	−0.047 (1.5)	−0.052 (1.7)	0.022 (0.4)	0.025 (0.6)
Top public	0.204 (1.7)	0.145 (1.2)	0.042 (1.4)	0.024 (0.9)	0.037 (0.6)	−0.008 (0.2)
Middle public	−0.014 (0.6)	−0.016 (0.6)	0.008 (0.6)	0.003 (0.2)	0.015 (0.6)	−0.014 (0.7)

Omitted category is bottom public. Results obtained from probit models estimated on four-year undergraduate college attendees which include (in addition to dummy variables shown above for undergraduate college quality) female, black, Hispanic, family size, family income, father's education, mother's education, test score. Models (2.2), (2.4), and (2.6) also include a dummy indicating if a bachelor's degree held as of the survey date. 1982 sample uses those with some graduate school credit based on transcript data. Sample sizes are 3101 for 1972, 2754 for 1980, and 2403 for 1982.

for final education level the top private coefficients remain statistically significant. Comparing the cross-cohort changes between 1972 and 1982 in columns (2.2) and (2.6) shows that the effect of attending a top private college on graduate school attendance, controlling for college completion, fell across cohorts from 12 percent to 5 percent. These results are consistent with findings from Brewer *et al.*, 1996, who showed that the annual earnings premium associated with attending a top private institution increased markedly between the 1972 and 1982 cohorts. To the extent that the increased earnings premium associated with elite private schools represents an increase in the opportunity cost of attending graduate school, the cross-cohort decline in the effect of attending a top private college on the probability of attending graduate school is to be expected. The estimated top private marginal effect fell between the 1972 and 1980 cohorts, although this finding should be interpreted cautiously since there is a large difference between cohorts in the potential number of years in which a student could attend graduate school (about 10 for the 1972 cohort and about 2 for the 1980 cohort).[10]

4.2. Effect of Undergraduate College Quality on the Type of Graduate School Attended

We next analyze the effect of college quality on the probability of attending graduate school by estimating a multinomial logit model with three outcomes: no graduate school attendance, graduate school attendance at a non-R1/R2 institution, and graduate school attendance at an R1/R2 institution. Results from the multinomial logit estimation are shown in Table 3, and are based on specifications both with and without controls for final education level.

The main findings for the 1972 cohort show that attending an elite private school has a positive but insignificant effect on attending a non-R1/R2 institution relative to no graduate school attendance, but that attending an elite private school has both a positive and significant effect on the probability of

attending an R1/R2 school relative to no graduate school attendance. These results are qualitatively the same whether or not we control for final education level. The elite private results for the 1980 cohort are similar to those of their 1972 predecessors: attending an elite private school has a positive but insignificant impact on attending a non-R1/R2 graduate school relative to not attending graduate school, while attending an elite private school increases the probability of attending an R1/R2 school. For the 1982 cohort, the results without controls for final education level (panel A, columns (3.5) and (3.6)) show that attending an elite private college significantly raises the likelihood of attending either an R1/R2 or a non-R1/R2 relative to not attending graduate school; however, when college graduation controls are included (panel B, columns (3.5) and (3.6)) only the result for non-R1/R2 remains statistically strong. Results for the 1982 cohort should be interpreted cautiously since the available data do not permit identification of the graduate school actually attended with certainty.[11]

5. CONCLUSIONS

In this paper we have shown that attending an elite private college increases the probability of attending graduate school, and more specifically, increases the likelihood of attending graduate school at a major research institution. We have provided these estimates for three cohorts of students (high school classes of 1972, 1980, 1982) which establishes that the college quality–graduate school relationship is generally robust across cohorts of students and at different points in time, although the effects of attending an elite private college on attending graduate school at a major research institution are strongest for the two earlier cohorts. We also found a cross-cohort decline in the effect that an elite private school has on graduate school attendance probabilities, and this result is consistent with previous work showing an increase in the annual earnings premium associated with elite private schools over the same cohorts,

Table 3. Multinomial logit estimates of the effects of undergraduate college quality on graduate school attendance (relative to no graduate school attendance) (absolute value *t* statistics)

	1972 Cohort		1980 Cohort		1982 Cohort	
	Research I/II	Other graduate school	Research I/II	Other graduate school	Research I/II	Other graduate school
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)
A. Without College Graduation Controls						
Top private	0.922 (2.8)	0.327 (1.3)	1.514 (2.9)	0.340 (0.8)	2.073 (1.9)	1.098 (2.7)
Middle private	0.242 (1.0)	0.060 (0.5)	0.128 (1.4)	0.485 (1.7)	1.747 (1.6)	0.715 (2.2)
Bottom private	−0.234 (0.5)	−0.185 (0.8)	−0.335 (0.3)	−0.803 (1.1)	−8.752 (0.0)	−0.246 (0.3)
Top public	0.943 (1.3)	0.641 (1.1)	1.084 (1.4)	0.484 (0.8)	1.567 (1.1)	0.965 (1.5)
Middle public	0.255 (1.2)	−0.171 (1.5)	1.087 (2.4)	−0.441 (1.5)	1.675 (1.6)	0.421 (1.3)
B. With College Graduation Controls						
Top private	0.750 (2.2)	0.154 (0.6)	1.410 (2.7)	0.203 (.5)	1.792 (1.6)	0.791 (1.9)
Middle private	0.084 (0.4)	−0.093 (0.7)	0.608 (1.2)	0.352 (1.2)	1.530 (1.4)	0.468 (1.4)
Bottom private	−0.361 (0.8)	−0.295 (1.2)	−0.373 (0.3)	−0.895 (1.2)	−11.382 (0.0)	−0.190 (0.2)
Top public	0.716 (0.9)	0.408 (0.7)	0.846 (1.1)	0.210 (0.4)	1.277 (0.9)	0.715 (1.1)
Middle public	0.196 (0.9)	−0.226 (1.8)	1.013 (2.2)	−0.534 (1.8)	1.586 (1.5)	0.290 (0.9)

Omitted category is bottom public. Results are shown relative to no graduate school attendance. Models also contain additional variables as in Table 2, models (2.1), (2.3), and (2.5), respectively.

which reflects an increased opportunity cost of graduate school attendance.

Our findings demonstrate a previously undocumented benefit of attending an elite private college. Previous studies which focused solely on the earnings premium associated with elite private schools may have underestimated the overall benefit of attending the top institutions. Since public concern recently has been concentrated on the increasing costs of attending the most selective private colleges, our findings that attending elite private schools increases graduate school attendance probabilities sheds additional light on the benefits of attending such schools.

NOTES

1. The actual net cost of college attendance is considerably less than the sticker price due to widespread financial aid in the form of student aid, grants, fellowships, tuition waivers, etc.
2. There are few studies analyzing the decision to attend graduate school, and none on the effect of undergraduate college quality on the probability of graduate school attendance. For studies on graduate school attendance see, for example, Fox, 1992; Shapiro *et al.*, 1991; and Weiler, 1994.
3. The R1/R2 Carnegie classifications are based on the number of Doctorates awarded by the institution and annual revenue from federal research support.
4. Sample weights supplied by NCES were used in generating the descriptive statistics. Figures for the 1980 cohort may be found in Brewer and Ehrenberg, 1996.
5. The fraction of men in top publics is higher than the other undergraduate college quality types because the US military academies fall into this category.
6. The set of individual characteristics is the same in each of our models, and includes controls for female, test score, race/ethnicity (black, Hispanic), family size, family income, father's educational attainment, and mother's educational attainment.
7. We were unable to separately analyze the choice between attendance for different *types* of graduate degrees as the HSB 1992 follow-up did not contain the necessary information to ascertain the type of graduate degree the student was pursuing.
8. There are some aspects of graduate school attendance which we recognize but do not attempt to model here. Such issues include the two-sided nature of graduate school enrollment (a student must both apply to and be accepted to a school), and the potential nested structure of the decision to enroll in graduate school and then within graduate school enroll in either R1/R2 or non-R1/R2. We attempted to control in a formal context for the effect of unobserved variables on students' self-selection into graduate school, but small sample sizes and no clear identifying variables made estimation problematic.

We roughly control for selection bias by including individual ability and family background measures in our models.

9. A potential problem with including final education level is it is likely an endogenous variable. However, by leaving final education level out of the model, part of the estimated college quality effect will reflect differences in college completion across college quality types. We therefore report both specifications to provide a range of estimates.

10. We performed sensitivity analyses for our three models by adding separately to our baseline specification controls for undergraduate college grades, undergraduate college major, and undergraduate debt, each of which may affect the decision to attend graduate school. While some of these variables were at times statistically significant, our main findings were not substantially affected by the inclusion of these variables. Results from the sensitivity analyses are not reported here, but are available upon request.

11. Instead we identified the graduate school "attended" using the first choice school applied to and accepted at (the only school identified) combined with transcript information to determine graduate school attendance.

REFERENCES

Behrman, J.R., Rosenzweig, M.R. and Taubman, P. (1995) Individual endowments, college choice, and wages: estimates using data on female twins. Revised paper for NSF/RESTAT Conference on School Quality and Educational Outcomes.

Bound, J. and Johnson, G. (1992) Changes in the structure of wages in the 1980s: an evaluation of alternative explanations. *Am. Econ. Rev.* **82**, 371–392.

Brewer, D.J. and Ehrenberg, R.G. (1996) Does it pay to attend an elite private college? Evidence from the senior high school class of 1980. *Res. Labor Econ.* **15**, 239–271.

Brewer, D. J., Eide, E. and Ehrenberg, R.G. (1996) Does it pay to attend an elite private college? Cross cohort evidence on the effects of college quality on earnings. National Bureau of Economic Research Working Paper No. 5613. Cambridge, MA.

Daniel, K., Black, D. and Smith, J. (1995) College quality and the wages of young men. Unpublished manuscript, University of Pennsylvania.

Eide, E. and Waehrer, G. (1998) The role of the option value of college attendance in college major choice. *Econ. Educ. Rev.* **17**, 73–82.

Fox, M. (1992) Student debt and enrollment in graduate and professional school. *Appl. Econ.* **24**, 669–677.

Grogger, J. and Eide, E. (1995) Changes in college skills and the rise in the college wage premium. *J. Hum. Resour.* **30**, 280–310.

Katz, L.F. and Murphy, K.M. (1992) Changes in relative wages, 1963-1987: supply and demand factors. *Q. J. Econ.* **107**, 37–78.

Loury, L.D. and Garman, D. (1995) College selectivity and earnings. *J. Labor Econ.* **13**, 289–308.

Morganthau, T. and Nayyar, S. (1996) Those scary college costs. *Newsweek* **127**, 52–58.

Shapiro, M.O., O'Malley, M.P. and Litten, L.H. (1991) Progression to graduate school from the "elite" colleges and universities. *Econ. Educ. Rev.* **10**, 227–244.

Weiler, W.C. (1994) Expectations, undergraduate debt and the decision to attend graduate school: a simultaneous model of student choice. *Econ. Educ. Rev.* **13**, 29–41.