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Is it a Good Investment to Attend an Elite Private College?

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Abstract — This paper attempts to determine whether the cost of attending elite private colleges bears a return comparable to other human capital investments. The empirical work compares the net present value of attending elite private colleges to that of less selective public colleges. The results imply that private investments in educational quality yield a rate of return which is at least equal to the return of investments in the quantity of education. If the real tuition differential between private and public colleges continues to rise, this rate of return will gradually fall. It is unclear whether attending an elite private college will remain a good private investment.

I. INTRODUCTION

ALTHOUGH THERE is a large and growing literature which examines the return to the quantity of higher education, far less attention has been paid to the issues relating to college quality. The research in this area has tended to focus on the impact of possible determinants of college quality (e.g. expenditure per student) on subsequent earnings. The impact of college selectivity on future earnings has also been explored (e.g. Morgan and Duncan, 1979). Several of the recent studies in this area are discussed by James *et al.* (1989). However, this work has not attempted to estimate a rate of return (ROR) to investments in educational *quality*. In general, the most prestigious colleges in the U.S.A. are private institutions which charge tuition well above that of public and other private schools. In this paper the cost differential between the most elite private colleges and public colleges is viewed as a human capital investment in educational quality. The ROR on this investment is calculated using a sample of recent college graduates and independent estimates of earnings growth by college selectivity. The key finding is that choosing an elite private college appears to be an investment which yields a private ROR at least comparable to that of investments in the quantity of education. However, the real rate of tuition has risen rapidly at both public and private colleges over the last decade. As elite private institutions charge far more than their public counterparts, the real cost differential between the two types of colleges has widened. If present trends continue, the ROR to attending elite private colleges will fall. As the magnitude of this effect is uncertain, it is unclear whether attending an elite private college will remain attractive.

This paper is divided into five sections. In Section II background information is provided on college tuition levels and the ranking of colleges used in this study. In Section III the data are discussed and the empirical approach is outlined. In Section IV the main results are presented. Several econometric issues are also discussed. Finally, Section V contains concluding comments and suggestions for future research.

II. BACKGROUND

Over the past several years there has been growing concern that the increase in the real level of college tuition has made it increasingly burdensome for families to send their children to college. Indeed, some educators have expressed the view that

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Table 1. Average annual increases in tuition and fees at 4-year colleges, 1980–1981 to 1986–1987

Academic year*	Public colleges (%)	Private colleges (%)	Percentage increase in consumer price index
1981	4	10	10.4
1982	16	13	6.1
1983	20	13	3.2
1984	12	11	4.3
1985	8	9	3.6
1986	9	8	1.9
1987	6	8	3.7

* Refers to the academic year ending that calendar year (i.e. 1981 refers to the 1980–1981 academic year).
Source: College Board.

entrance to elite private colleges will soon be restricted to students from affluent backgrounds. In Table 1 the average annual rate of tuition increase is presented for public and private colleges from 1981 to 1987. Except for 1981, the annual rate of tuition increase at both public and private colleges rose faster than the consumer price index (CPI) for each of the sample years. Over this 7-year period, the CPI rose by 38%. However, the cost of attending public and private colleges rose by 102 and 98%, respectively. Therefore, the real level of tuition at both public and private colleges rose by approximately 50%. Although during this period the average rate of tuition increase was almost identical at both public and private colleges, particular attention has been paid to the latter because they typically charge far more than public institutions. For example, during the 1987–1988 school year tuition at 4-year public and private colleges averaged $1462 and $5963, respectively.[1] However, the latter figure may be misleading because the most elite and selective private colleges typically charge far more than other private institutions.

Every few years Barrons publishes *Profiles of American Colleges*, which breaks down colleges into six levels of selectivity. Table 2 presents the criteria used to determine the appropriate category for each college. Table 3 provides a list of colleges which are in the top two categories. It is interesting that except for the service academies, only one (Michigan) of the most competitive institutions is public. The vast majority of the highly competitive colleges are also private. Although the few public colleges in the highly competitive category would appear to be excellent options for those students who are admitted, in general, the most elite colleges in the U.S.A. are private. During the 1987–1988 academic year, average tuition at the private colleges in these two categories was $10,824.[2] Therefore, these institutions charge almost twice as much as other private schools — and approximately seven times as much as public colleges. Even if most admitted students are able to acquire the financial resources necessary to attend these elite colleges, the intriguing question remains whether this additional expenditure yields a ROR comparable to that of

Table 2. Barrons' selectivity index

Category	Class rank	High school grade point average	Average SAT scores	% admitted
Most competitive	Top 10–20%	A to B+	625–800	less than 33%
High competitive	Top 20–35%	B+ to B	575–625	33–50%
Very competitive	Top 35–50%	B− or above	525–575	50–75%
Competitive	Top 50–65%	Usually C+ or better	450–525	75–85%
Less competitive	Top 65%	Often below C	200–450	more than 85%
Non competitive	Only high school diploma required	n.a.	n.a.	n.a.

n.a. = Not applicable.

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Table 3. Colleges listed as being most or highly selective by Barrons' *Profiles of American Colleges*

Most competitive	High competitive
Amherst	Babson
Bowdoin	Bates
Brown	Boston College
Bryn Mawr	Boston University
Cal Tech	Brandeis +
Claremont/Harvey Mudd	Bucknell
Claremont/Pomona	Cal State-Dominguez Hills
William and Mary	Carleton +
Columbia College/Columbia U.	Carnegie Mellon
Columbia School of Engineering	Case Western +
Cooper Union	Claremont/McKenna
Cornell	Colby
Dartmouth	Colgate
Duke	Holy Cross
Georgetown	Colorado College
Harvard and Radcliffe	Colorado School of Mines +
Haverford	Barnard College +
Johns Hopkins	Columbia School of General Studies
Middlebury	Connecticut College
Northwestern	Davidson College +
Princeton	Dickinson College
Rice	Emory University
Stanford	Fairfield
Swarthmore	Franklin and Marshall
Tufts	Georgia Tech
U.S. Coast Guard Academy	Gettysburg
U.S. Military Academy	GMI +
U.S. Naval Academy	Grinnell +
Michigan/Ann Arbor	Hamilton
U. of Notre Dame	Kalamazoo
Pennsylvania	Kenyon +
Washington and Lee	Lafayette
Webb	Lawrence
Wellesley	Lehigh
Wesleyan	Macalester +
Williams	Miami/Ohio
Yale	Mount Holyoke
	New College
	NYU
	Oberlin +
	Occidental
	Reed +
	Rensselaer +
	Rhodes +
	Rose-Hulman
	Rutgers/College of Engineering
	Rutgers/College of Pharmacy
	Rutgers/Rutgers College
	Saint Olaf
	Simon Rock/Bard College
	Skidmore
	Smith
	SUNY-Albany
	SUNY-Binghamton
	SUNY-Geneseo
	Thomas Aquinas
	Trinity/CT

Table 3 — *Continued*

Most competitive	*High competitive*
	Trinity/TX +
	Tulane
	Union
	U.S. Air Force Academy
	U.S. Merchant Marine Academy
	Berkeley
	UCLA
	U. of Chicago +
	Illinois/Urbana +
	North Carolina/Chapel Hill
	U. of Richmond
	U. of Rochester
	U. of the South
	Virginia +
	Vanderbilt +
	Vassar +
	Villanova
	Wake Forest
	Washington/MO +
	Worcester Polytechnic Institute +

+ Slightly more competitive than the other schools in this category.

other human capital investments. Moreover, if tuition at public and elite private institutions continues to grow at approximately the same rate, the higher level of tuition at private schools implies that the real cost differential will widen over time. This suggests that the ROR to educational *quality* (i.e. incurring the additional cost association with attending an elite private college) may eventually fall below the average ROR to investments in the quantity of education. This in turn could induce some students to decline admission to elite private colleges in favor of cheaper public institutions — and use their tuition savings to finance other types of investment in human and non-human capital.

III. DATA AND EMPIRICAL APPROACH

The empirical analysis in this paper uses the 1980 High School and Beyond (HSB) survey of high school seniors. Follow-up surveys were conducted in 1982, 1984 and 1986. The sample used in this paper consists of members of the initial sample who had completed college by 1986.[3] Observations were deleted if data were missing on one or more of the key variables of interest.

The first stage of the empirical work is to estimate a standard human capital model. The dependent variable is the logarithm of the hourly wage.[4] As the survey indicates the college attended by each recent graduate, a dummy variable is included to control for whether the graduate attended a MOSTHIGH (most of highly competitive) college.[5,6,7] The initial wage premium (if any) received by graduates of selective colleges may then be computed. It is then possible to compute expected full-time annual earnings.

The next phase of the empirical work involves simulating earnings profiles for two groups: (1) graduates of private colleges in the most or highly selective categories (MOSTHIGH) and (2) graduates of public colleges from the remaining categories. Although the HSB may be used to measure the impact of college quality on initial earnings, additional information is necessary to determine salary profiles because wage data are only available for a short period following graduation. In order to determine these profiles, several hypothetical earnings growth rates are used. In particular, earnings growth rates calculated by Wise (1975) are used to determine simulated earnings profiles.

As earnings data are available for 1986, the study considers the decision faced by a representative student entering college in 1982–1983 and graduat-

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Table 4. Wage equations of recent college graduates — 1986

	1	2	3	4	5	6	7
INTERCEPT	1.92*	2.02*	1.97*	1.84*	1.83*	1.84*	1.85*
	(0.027)	(0.047)	(0.096)	(0.12)	(0.125)	(0.124)	(0.126)
AMERIND	−0.073	−0.032	−0.026	−0.025	−0.026	−0.025	−0.026
	(0.112)	(0.10)	(0.098)	(0.095)	(0.096)	(0.095)	(0.095)
BLACK	−0.055	−0.026	0.007	0.031	0.03	0.031	0.034
	(0.051)	(0.051)	(0.052)	(0.053)	(0.054)	(0.054)	(0.054)
ASIAN	0.08‡	0.097	0.088	0.077	0.078	0.077	0.081
	(0.07)	(0.069)	(0.066)	(0.066)	(0.067)	(0.067)	(0.066)
DADBABS	0.015	−0.01	−0.016	−0.016	−0.016	−0.016	−0.014
	(0.039)	(0.04)	(0.041)	(0.041)	(0.041)	(0.041)	(0.04)
DADGRAD	0.018	−0.017	−0.013	−0.017	−0.015	−0.017	−0.012
	(0.049)	(0.049)	(0.049)	(0.050)	(0.05)	(0.05)	(0.05)
MOMBABS	−0.048	−0.067	−0.073	−0.073	−0.074	−0.074	−0.074
	(0.044)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
MOMGRAD	−0.0002	−0.026	−0.028	−0.026	−0.027	−0.026	−0.029
	(0.065)	(0.064)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)
MAJBUSIN	0.084†	0.078†	0.073†	0.071†	0.071†	0.071†	0.073†
	(0.033)	(0.033)	(0.033)	(0.033)	(0.032)	(0.033)	(0.033)
MAJENGIN	0.30*	0.30*	0.278*	0.265*	0.266*	0.265*	0.265*
	(0.05)	(0.05)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)
MAJEDUC	0.033	0.036	0.058	0.057	0.057	0.057	0.053
	(0.056)	(0.055)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)
MALE	0.06†	0.06†	0.08*	0.066†	0.082*	0.066†	0.065†
	(0.03)	(0.03)	(0.03)	(0.031)	(0.031)	(0.031)	(0.031)
MOSTHIGH	0.199*	0.18*	0.154†	0.138†	0.136‡	0.139†	0.138†
	(0.068)	(0.068)	(0.067)	(0.068)	(0.07)	(0.068)	(0.068)
VERYCOM	—	—	—	—	—	—	−0.004
							(0.036)
LESSCOM	—	—	—	—	—	—	−0.036
							(0.040)
NONCOM	—	—	—	—	—	—	0.10
							(0.09)
FAMOT12	—	−0.26*	−0.29*	−0.28*	−0.28*	−0.28*	−0.28*
		(0.057)	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
FAM12T20	—	−0.084‡	−0.102‡	−0.098‡	−0.098‡	−0.098‡	−0.098‡
		(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.05)
FAM20T38	—	−0.085*	−0.100†	−0.098†	−0.096†	−0.098†	−0.10†
		(0.043)	(0.042)	(0.041)	(0.042)	(0.041)	(0.04)
HSMOSTA	—	—	0.143	0.11	0.11	0.11	0.11
			(0.089)	(0.092)	(0.092)	(0.092)	(0.092)
HSMOSTAB	—	—	0.063	0.04	0.04	0.04	0.042
			(0.089)	(0.091)	(0.091)	(0.091)	(0.091)
HSMOSTB	—	—	−0.007	−0.017	−0.018	−0.018	−0.019
			(0.092)	(0.093)	(0.094)	(0.093)	(0.094)
HSMOSTBC	—	—	−0.053	−0.052	−0.051	−0.052	−0.057
			(0.093)	(0.094)	(0.095)	(0.095)	(0.096)
VERBSCOR	—	—	—	−0.0036	−0.0037	−0.0036	−0.0039
				(0.0054)	(0.0054)	(0.0054)	(0.0054)
MATHSCOR	—	—	—	0.0099†	0.0099†	0.01†	0.0096†
				(0.0047)	(0.0047)	(0.0047)	(0.0047)
PRIVATE	—	—	—	—	0.0098	—	—
					(0.033)		
PRIVCOM	—	—	—	—	—	0.0019	—
						(0.033)	
R^2	0.07	0.09	0.11	0.11	0.11	0.11	0.12
N	853	853	853	853	853	853	853

Note: Standard errors in parentheses.
*Statistically significant at 0.01 level.
†Statistically significant at 0.05 level.
‡Statistically significant at 0.10 level.

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Table 5. Variable definitions

WAGE	Hourly wage
AMERIND	1 if person is native American 0 otherwise
BLACK	1 if person is black 0 otherwise
ASIAN	1 if person is Asian 0 otherwise
DADBABS	1 if father has a bachelor's degree but no additional training 0 otherwise
DADGRAD	1 if father has completed schooling beyond the bachelor's degree 0 otherwise
MOMBABS	1 if mother has a bachelor's degree but no additional training 0 otherwise
MOMGRAD	1 if mother has completed schooling beyond the bachelor's degree 0 if otherwise
MAJBUSIN	1 if major was in business 0 otherwise
MAJENGIN	1 if major was in engineering 0 otherwise
MAJEDUC	1 if major was in education 0 otherwise
MALE	1 if male 0 if female
MOSTCOM	1 if graduated from a "most" competitive college 0 otherwise
HIGHCOM	1 if graduated from a "highly" competitive college 0 otherwise
MOSTHIGH	1 if graduated from a MOSTCOM or HIGHCOM college 0 otherwise
VERYCOM	1 if graduated from a "very" competitive college 0 otherwise
COM*	1 if graduated from a "competitive" college 0 otherwise
LESSCOM	1 if graduated from a "less" competitive college 0 otherwise
NONCOM	1 if graduated from a "noncompetitive" college 0 otherwise
FAMOT12	1 if family income was less than $12,000 at beginning of college 0 otherwise
FAM12T20	1 if family income was between $12,000 and $20,000 at beginning of college 0 otherwise
FAM20T38	1 if family income was between $20,000 and $38,000 at beginning of college 0 otherwise
FAMOV38*	1 if family income was above $38,000 at beginning of college 0 otherwise
HSMOSTA	1 if student received mostly grades of A in high school 0 otherwise
HSMOSTAB	1 if student received mostly grades of A and B in high school 0 otherwise
HSMOSTB	1 if student mostly received grades of B in high school 0 otherwise
HSMOSTBC	1 if student mostly received grades of B and C in high school 0 otherwise
HSCORBEL*	1 mostly received grades of C or below 0 otherwise
VERBSCOR	score on the verbal aptitude test given as part of HSB
MATHSCOR	score on the mathematical aptitude test given as part of HSB
PRIVATE	1 if student attended a private college 0 otherwise
PRIVCOM	1 if student attended a private non-MOSTHIGH college 0 otherwise

*Variable does not appear in the regressions below because it is a reference category.

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ing 4 years later. The tuition levels for private MOSTHIGH colleges and public colleges are calculated using the average rates of tuition increase reported in Table 1.[8] Earnings and tuition levels are deflated by the CPI to 1983 levels. The net present values of both profiles (i.e. including the cost of tuition) are calculated for various discount rates. It is assumed that the college graduate works for 40 years (i.e. retires in the year 2027).[9] The ROR of investing in a private MOSTHIGH college is equal to the discount rate at which the net present values of both profiles are identical.

IV. EMPIRICAL RESULTS

The earnings equations are estimated using ordinary least squares. The results are shown in Table 4.[10] Variable definitions are given in Table 5 and descriptive statistics are presented in Table 6. These regressions imply that students who majored in certain fields (e.g. engineering) received an earnings premium over that of other college graduates. These findings are consistent with those of other researchers (e.g. James *et al.*, 1989; Morgan and Duncan, 1979).

The coefficients of the college selectivity dummy variables are of primary interest. The coefficient of MOSTHIGH is positive and significant in all of the specifications presented in Table 4. However, its magnitude falls if family income and several additional ability control variables are included.[11] Some previous work (e.g. Griffin and Alexander, 1978) has found that holding other variables constant, family income is positively associated with post-college earnings. It is likely that affluent high school students have a relatively high propensity to attend elite private colleges. If so, omission of family income will yield estimated coefficients of MOSTHIGH which are upward biased.

The ability control variables include both high school grades and scores on verbal and quantitative aptitude tests (VERBSCOR and MATHSCOR) given as part of the HSB. These tests have been shown to be highly correlated with ACT and SAT scores (Hanushek and Taylor, 1990). The coefficient of MATHSCOR is positive and significant (see column 4 of Table 4). College grade point average (GPA) is deliberately excluded from the set of independent variables. Holding ability constant, attending an elite college is likely to be negatively correlated with GPA because more selective

Table 6. Descriptive statistics

	Variable means
AMERIND	0.007 (0.008)
BLACK	0.11 (0.31)
ASIAN	0.047 (0.212)
DADBABS	0.20 (0.40)
DADGRAD	0.17 (0.37)
MOMBABS	0.16 (0.37)
MOMGRAD	0.087 (0.282)
MAJBUSIN	0.244 (0.430)
MAJENGIN	0.095 (0.293)
MAJEDUC	0.10 (0.30)
MALE	0.44 (0.50)
MOSTHIGH	0.095 (0.293)
VERYCOM	0.191 (0.393)
LESSCOM	0.127 (0.333)
NONCOM	0.048 (0.214)
FAMOT12	0.10 (0.30)
FAM12T20	0.29 (0.45)
FAM20T38	0.42 (0.49)
HSMOSTA	0.31 (0.46)
HSMOSTAB	0.34 (0.47)
HSMOSTB	0.20 (0.40)
HSMOSTBC	0.13 (0.33)
VERBSCOR	9.20 (3.13)
MATHSCOR	19.39 (4.0)
WAGE	8.47 (6.36)
PRIVATE	0.30 (0.45)
PRIVCOM	0.24 (0.43)
N	853

Note: Standard deviations in parentheses.

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colleges are more competitive and have more rigorous standards. Therefore, if college GPA is included in the regressions, the impact of college selectivity may be overestimated.

When the full set of controls was included, the earnings premium associated with attending a MOSTHIGH college is estimated to be slightly over 13% (see Table 4). This figure is used to generate the simulated earnings profiles reported below.[12]

It may appear questionable to include selectivity dummy variables in the regressions because they are merely proxies for the true determinants of educational quality. However, scholars have not fully isolated those features which raise productivity and future earnings. Indeed, James *et al.* (1989) find that such variables as expenditure per student and presence of research and graduate programs have an insignificant effect on future earnings.[13] By contrast, previous studies (e.g. James *et al.*, 1989; Morgan and Duncan, 1979) have consistently found a strong link between college selectivity and subsequent earnings. Moreover, the Barrons selectivity index reflects the degree of difficulty students encounter in getting admitted to different colleges. Therefore, it would appear to be a good proxy for college quality as perceived by consumers of educational services.

One implication of using selectivity as a proxy for college quality is that the earnings of graduates of elite colleges may not reflect the superior quality of these institutions. Rather, such a finding may be due to the process which selects the most able students into the top colleges.[14] This point has been made by many scholars (e.g. James *et al.*, 1989; Morgan and Duncan, 1979; Wales, 1973). The implication is that the estimated ROR to attending an elite college may be upward biased.[15] Willis and Rosen (1979) find that the ROR to college for those who actually attended was 9.9%. Among those students who did not attend college, the ROR they would have received was 9.3%. This implies that selection bias may be small. However, the decision whether or not to attend college is not identical to the selection process being considered here. Therefore, the magnitude of the sample selectivity bias is uncertain.

The next stage of the empirical work is to use earnings growth rates to generate simulated earnings profiles. Wise (1975) uses a sample of Ford workers to estimate earnings growth rates by grade point average and college selectivity.[16] These figures are reported in Table 7.[17] The earnings growth rates from the second row (i.e. those students whose grade point averages ranged from 3.00 to 3.49) are used to calculate earnings profiles for graduates of private MOSTHIGH colleges and public colleges in the other categories.[18] These earnings profiles are combined with the tuition information presented above to calculate the ROR to attending a private MOSTHIGH college instead of a less selective public institution.[19]

In constructing these simulated rates of return it is assumed that all college graduates work 2000 hours annually.[20,21] Such a procedure would be inappropriate if the labor supply of graduates of MOSTHIGH colleges differed from that of other college graduates. Indeed, it seems plausible that the number of hours worked is influenced by wages or choice of college. However, both groups worked an average of approximately 40 hours per week.[22,23]

The results are shown in Table 8.[24] In the first row the earnings growth rate of graduates of private MOSTHIGH colleges is assumed to be 0.049. If graduates of non-MOSTHIGH colleges have an earnings growth rate of 0.037, the ROR to attending a private MOSTHIGH college is 14.9%. The estimated ROR falls to 13.8% if graduates of non-MOSTHIGH colleges are assumed to receive an earnings growth rate of 0.041.

These findings are interesting in that they are slightly greater than estimates of the return to investments in the *quantity* of education. For example, McConnell and Brue (1989; pp. 87–88) note that the estimated ROR to investments in the

Table 7. Estimated earnings growth rates by grade point average (GPA) and college selectivity (SEL)

	SEL1	SEL2	SEL3	SEL4	SEL5	SEL6
GPA1	0.05643	0.04792	0.04680	0.04375	0.04127	0.03731
GPA2	0.04921	0.04070	0.03958	0.03653	0.03405	0.03009
GPA3	0.04621	0.03770	0.03658	0.03353	0.03105	0.02709
GPA4	0.04279	0.03428	0.03316	0.03011	0.02763	0.02367

Source: Wise (1975).

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Table 8. Rates of return from attending a private MOSTHIGH college

		Earnings growth rates of public colleges not in the MOSTHIGH category			
		0.049	0.041	0.037	0.030
Earnings growth rates of private MOSTHIGH colleges	0.049	10.3	13.8	14.9	—
	0.030	—	—	—	8.6

quantity of higher education range from 10 to 15%. In a recent survey paper, Psacharopoulos (1985) notes that the private ROR to higher education in advanced countries is approximately 12%. Thus, these simulations imply that attending a selective college is a good private investment — even if it is private and expensive.

It is clear that the estimated rates of return are somewhat sensitive to the growth rates used to generate the earnings profiles. As noted above, the survey used by Wise (1975) was conducted at a single firm, therefore, it may not be nationally representative. Moreover, as the salary survey was conducted in the late 1960s, the earnings growth rates may differ considerably from that of students who completed college almost two decades later.[25] However, the Wise study unambiguously suggests that graduates of selective colleges have steeper earnings profiles than other college graduates. Therefore, the ROR to attending a private MOSTHIGH college will be conservatively estimated if all college students are assumed to have identical earnings growth rates.

The results of this procedure are reported in Table 8. The two hypothetical earnings growth rates are 0.049 and 0.03. The corresponding rates of return are 10.3 and 8.6%, respectively. The first figure is similar in magnitude to most estimates of the ROR to the quantity of higher edcuation. Moreover, both estimates are likely to be biased downwards because they are derived under the assumption that all college graduates have identical earnings growth rates. Therefore, it is a fairly robust finding that investments in educational quality yield a ROR at least equal to investments in educational quantity.

These simulations have compared the net earnings profiles of graduates of private MOSTHIGH colleges with those of graduates of non-MOSTHIGH public colleges. While almost all MOSTHIGH colleges are private, the other selectivity categories contain a large number of both public and private institutions. If private college graduates earn more (less) than public college graduates, the regressions reported in Table 4 will understimate (overestimate) the return to attending a private MOSTHIGH college rather than a public non-MOSTHIGH institution. James *et al.* (1989) suggest that while private colleges may utilize resources more efficiently, they may be hampered by the need to do substantial fundraising. Using data from the National Longitudinal Survey, James *et al.* (1989) find no earnings differential between public and private college graduates.[26] Nevertheless, it is worth testing whether the earnings equations in this study are altered if the type of college is included as an independent variable.

In Table 4 the variable PRIVATE (college is private) is included in one specification to test whether the earnings premium associated with attending a MOSTHIGH college is sensitive to whether the student attended a public or private institution. The interaction variable PRIVCOM (college is non-MOSTHIGH and private) is included in another specification in order to test whether there is a public/private earnings differential among non-MOSTHIGH colleges. The coefficients of both PRIVCOM and PRIVATE are small and insignificant. Moreover, the coefficients of MOSTHIGH and the other independent variables are essentially unaffected (compare the results in columns 4–6). These results suggest that the simulated rates of return reported in Table 8 do in fact correctly measure the ROR to attending a private MOSTHIGH college instead of a public non-MOSTHIGH school.[27]

The simulations reported in Table 8 imply that it is still a good private investment to attend a private MOSTHIGH college. Yet from 1980 to 1987 the real level of tuition at both public and private colleges increased by approximately 50%. As the tuition level at private colleges is greater, during this period the real tuition differential between the two types of institutions rose. This was particularly true of the relatively expensive MOSTHIGH private colleges. If these trends continue, the real 4-year tuition differential between private MOSTHIGH colleges and public colleges will rise by over $13,000 from 1986 to 1993.[28] This in turn suggests that the ROR to attending an elite college will gradually fall.

In order to determine the magnitude of this effect, the ROR calculations are redone under the assumption that the real level of tuition at all colleges rises by 50%. In calculating the rates of return, it is initially assumed that real starting salaries of new college graduates will increase by 2.5% annually over the 7-year period.[29] This figure is equal to the average growth rate from 1976 to 1987.[30] However, this growth rate was very uneven. From 1976 to 1981 real starting salaries of new colleges graduates grew at an average annual rate of 4.6%. By using both figures, it is possible to determine whether ROR estimates are sensitive to the growth rate in starting salaries.

In Table 9 the ROR estimates are calculated under the assumption that real starting salaries rise 2.5% annually. As a 50% increase in real tuition widens the tuition differential between public non-MOSTHIGH and private MOSTHIGH colleges, these ROR estimates are smaller than those reported in Table 8. However, it is clear that attending a MOSTHIGH college remains a good investment if MOSTHIGH graduates have earnings growth rates which exceed those of other colleges. Consider the case where the earnings growth rates of the two groups are 0.049 and 0.037, respectively. These simulations imply that the ROR to attending a MOSTHIGH COLLEGE is 13.3%. If the earnings growth rate of graduates of non-MOSTHIGH colleges is assumed to be 0.041, the ROR is 12.2%. Moreover, attending a MOSTHIGH college may remain a good investment if the earnings growth rates for MOSTHIGH and non-MOSTHIGH graduates are identical. In Table 10 the growth rate in starting salaries is assumed to be 4.6%. If graduates of both MOSTHIGH and non-MOSTHIGH colleges are assumed to have earnings growth rates of 0.049, the ROR to attending a

Table 9. Rates of return from attending a private MOSTHIGH college if real tuition rises by 50% and starting salaries rise by 2.5% annually

		Earnings growth rates of public colleges not in the MOSTHIGH category			
		0.049	0.041	0.037	0.030
Earnings growth rates of private MOSTHIGH colleges	0.049	8.8	12.2	13.3	—
	0.030	—	—	—	7.0

Table 10. Rates of return from attending a private MOSTHIGH college if real tuition rises by 50% and starting salaries rise by 4.6% annually

		Earnings growth rates of public colleges not in the MOSTHIGH category			
		0.049	0.041	0.037	0.030
Earnings growth rates of private MOSTHIGH colleges	0.049	9.7	13.2	14.2	—
	0.030	—	—	—	7.9

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MOSTHIGH college is 9.7%. This figure is comparable to some estimates of the ROR to investments in the quantity of education.

While attending a MOSTHIGH college may still yield a high ROR if the real level of tuition rises by 50%, this finding is not robust. Suppose that the earnings growth rate for all college graduates was 0.03. The corresponding rates of return are 7.0 and 7.9% (see Tables 9 and 10). These figures are lower than most estimates of the ROR to higher education. As noted above, such estimates are likely to be biased downwards because of the steeper earnings profiles of MOSTHIGH graduates, yet the magnitude of this bias is unclear. If the present rate of tuition growth continues, it is plausible that before the end of the next decade investments in educational quality may yield a ROR below that of investments in the quantity of education. This in turn may induce marginal students to substitute towards alternative investments in human and nonhuman capital.

These simulated earnings profiles are based upon the assumption that college graduates immediately enter the labor force and work continuously until retirement. However, it is also possible that college graduates enter graduate or professional school (GPS). If attending a MOSTHIGH college raises the likelihood of admission to top GPS, the simulated profiles described above may underestimate the return to educational quality because this potential indirect return is ignored. Such a finding would strengthen the main conclusion of this paper that attending a MOSTHIGH college remains a good private investment.

In Table 11 the proportion of 1986 college graduates who entered within 1 year of graduation is broken down by college selectivity category.[31] Regardless of selectivity category, the vast majority of college graduates did not immediately enter GPS.

Table 11. Proportion of college graduates who immediately enter graduate or professional school by college selectivity

MOSTHIGH	0.40
VERYCOM	0.30
COM	0.30
LESSCOM	0.23
NONCOM	0.26

Source: These computations were derived using data from the Survey of 1985–1986 College Graduates (1987).

It is clear that many 1986 college graduates may have postponed entering GPS for several years. However, it is likely that the ROR estimates reported above apply to a large number of college graduates who will never enter GPS.

The figures in Table 11 show that MOSTHIGH graduates have a relatively high propensity to enroll in GPS. This may be viewed as indirect evidence that MOSTHIGH graduates have an advantage in getting admitted to GPS. It seems quite plausible (even likely) that selective GPS programs give preference to MOSTHIGH graduates because they are perceived to have completed more rigorous undergraduate programs. However, it was argued above that holding ability constant, college grade point average will be negatively correlated with college selectivity because elite colleges have more rigorous standards.[32] If so, students who choose to attend MOSTHIGH colleges may not significantly enhance their chances of getting admitted to top GPS programs. It would be useful for subsequent research to study these issues in greater detail.

V. CONCLUSIONS

This paper has studied the ROR to attending elite private colleges. It was noted that the vast majority of the most selective colleges in the U.S.A. are private. They typically charge more than other private colleges and far more than public institutions. This paper compared the net earnings profiles (earnings minus tuition) of graduates of elite private colleges and less selective public colleges. The cost differential between these two types of institutions was viewed as a human capital investment in educational quality. The empirical work was aimed at calculating an internal ROR to this type of investment. Several hypothetical earnings growth rates were used in order to simulate earnings profiles. The results implied that the rate of return to educational quality is at least comparable to, and is likely to be greater than, the return to investments in the quantity of higher education. However, the gradually widening cost differential between public and private colleges suggests that this rate of return is falling. By the end of the next decade, attending an elite private college may no longer be an attractive investment.

This area of inquiry could be extended in a few

ways. For example, it would be useful to investigate whether attending an elite undergraduate college significantly raises the probability of being admitted to top graduate and professional schools. Another interesting line of work would be to identify those factors which determine entry to selective colleges. Such research may provide a better understanding of issues regarding school quality at all levels of education.

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NOTES

1. These figures are calculated by deflating the tuition levels for the 1989–1990 school year by the rates of annual tuition increase reported by the College Board. Estimated room and board costs are not included.
2. This was calculated by using the tuition levels at each school listed in Barrons (1988). Cooper Union (which did not charge tuition) and colleges which admitted only women were not included in calculating this figure. However, tuition at single sex colleges was comparable to that of the other schools. Therefore, including these institutions would not change this tuition figure. Schools which had a religious affiliation (e.g. Georgetown) were included. Estimated room and board costs are not included in this figure.
3. All of the college graduates used in the empirical work had been out of college less than 2 years.
4. In most cases workers were not paid on an hourly basis. Therefore, the hourly wage was calculated by dividing total salary (annual, weekly, etc.) by the number of hours worked.
5. In many cases, members of HSB attended more than one college. In these instances, the selectivity category was determined by the college from which the student graduated.
6. The most and highly selective categories are combined into the MOSTHIGH category because less than 2% of the sample attended a MOSTCOM college.
7. The empirical work below did not reveal evidence of earnings differentials among the other four selectivity categories (see Table 4). Therefore, these categories are combined in the earnings simulations discussed below.
8. This figure does not include the cost of room and board. These expenses are almost identical at both public and private institutions. It may be argued that students who attend local public colleges are more likely to live at home than those who attend elite private colleges. However, this possibility is ignored here.
9. In preliminary work the simulations were estimated using different retirement ages. This procedure had a negligible impact on the estimated rates of return. An alternative possibility is that retirement age is endogenous (e.g. MOSTHIGH graduates retire later because of their higher earnings). This issue is not considered here.
10. Specification tests revealed evidence of heteroscedasticity. For this reason, the results reported in Table 4 use the procedure proposed by White (1980) to get consistent estimates of the standerd errors of the regression coefficients.
11. In the HSB survey family income is divided into income categories. As the excluded dummy variable is FAMOV38 (family income exceeds $38,000) the negative coefficients of the family income dummy variables imply that earnings are an increasing function of family income.
12. In Table 4 the magnitude of MOSTHIGH is as low as 0.136. By assuming that the earnings premium is 13%, the return to attending a MOSTHIGH college is conservatively estimated.
13. There are alternative measures of college quality which could be used. For example, Wales (1973) uses Gourman ratings to rank different institutions. However, he notes that, "it is unclear to what extent the quality variable is reflecting educational quality as opposed to individual scholastic abilities (by measuring selection of entrance to college)". Therefore, use of Gourman rankings does not eliminate the problem that high ability students are more likely to attend more elite institutions.
14. As elite institutions presumably admit more skilled students than other colleges, the economic return to attending a top school may be due in part to the signalling effect that the degree has on potential employers. Indeed, it is possible that students attend prestigious colleges in order to signal ability — but that these schools do not have a greater impact on worker productivity than other institutions. The seminal theoretical analysis of signalling is by Spence (1973), who suggested that

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education is acquired by workers in order to 'signal' quality to potential employers. For recent empirical tests of this hypothesis see Lang and Kropp (1986), Weiss (1988), and Boissiere *et al.* (1985). The relationship between signalling and school quality is considered by Hanushek (1986).

15. The regressions reported in Table 4 include a full set of background variables (high school grades, test scores) which at least partially control for unobserved ability. Use of this specification may reduce this bias.
16. As noted above, these selectivity categories are similar but not identical to the Barrons index.
17. The grade point average intervals are GPA1, 3.5–4.0; GPA2, 3.00–3.49; GPA3, 2.50–2.99; GPA4, less than 2.50.
18. The earnings growth rate differentials across selectivity groups do not vary greatly by grade point average category. Therefore, using another row would have a minimal effect on the estimated rates of return.
19. These estimates assume that the earnings growth rate is constant. Therefore, this analysis abstracts from the fact that cross-sectional studies have found that earnings profiles are concave and are eventually downward sloping. However, some longitudinal studies have found that earnings rise until retirement.
20. The HSB has limited information on annual hours worked. However, it does indicate weekly hours worked at the most recent job.
21. In order to check whether the simulated rates of return are very sensitive to this condition, this procedure was redone by assuming that college students worked 1500 and 2500 hours annually. Given the wage premium associated with attending a MOSTHIGH college, the estimated rates of return are an increasing function of annual hours worked. However, even if college graduates only work 1500 hours annually, attending a private MOSTHIGH college remains a good investment under some assumptions. For example, suppose that the earnings growth rate for both MOSTHIGH and non-MOSTHIGH college graduates was 0.049. This implies that the rate of return to attending a MOSTHIGH college would be 8.5%. This figure is slightly below most estimates of the return to investments in educational quantity. If the earnings growth rate of non-MOSTHIGH college graduates was 0.041, the rate of return to attending a MOSTHIGH college would be 11.8% — which is comparable to most estimates of the return to investments in educational quantity.
22. Mean weekly hours for MOSTHIGH and non-MOSTHIGH college graduates were 39.9 and 40.2, respectively.
23. Estimating the return to college quality would have been slightly more complex if there was evidence that choice of college is related to mean hours worked. Marder and Wilke (1991) estimate rates of return to different medical specialities. As mean hours worked varies widely across specialty, their procedure has two stages. First, the hourly wage is computed for both the base specialty and the alternative specialty under consideration. Second, Laspeyres-type (hours are standardized to the base specialty) and Paasche-type (hours are standardized to the alternative specialty) adjustments are made to calculate rates of return. For a further discussion and critique of this approach, see Sindelar (1991).
24. The calculations used in determining these rates of return assume that the representative student pays full tuition. In practice, approximately 60–65% of the students at private MOSTHIGH colleges receive financial aid in the form of grants and loans, many of which are subsidized. Clearly, any individual decision whether or not to attend a private college will depend on the financial aid package.
25. This is due in large part to the simultaneous relationship between college enrollment and the return to investments in higher education. Freeman (1975) finds that the return to the quantity of higher education fluctuates greatly. There is also considerable evidence that choice of college major or graduate field of study is very sensitive to expected future earnings. See Freeman (1975, 1976) for evidence that cobweb models may explain enrollment in engineering and law programs.
26. While James *et al.* (1989) do not find that private college graduates earn more than public college graduates, they do find that graduates of private colleges in the East receive an earnings premium. The authors argue that such colleges are more "elite" than other institutions. As the quality of these colleges is probably captured by the Barrons' selectivity dummy variables, these findings are consistent with those in Table 4.
27. While cheaper than private MOSTHIGH colleges, less selective private colleges are still more expensive than public institutions. Yet graduates of these less selective private schools do not receive an earnings premium over public colleges of comparable selectivity. This raises the intriguing question: why do students enroll at such institutions? It is possible that private colleges provide certain amenities not available at public institutions. For example, certain students may be attracted to denominational colleges. This issue would be a useful topic for further research.
28. The 1993 tuition figures are calculated by determining the total real level of tuition paid by 1986 college graduates who attended college continuously during the 4 academic years from 1982–1983 to 1985–1986. These 1986 total tuition figures are multiplied by 1.5 to get estimates of the total real level

of tuition that would be paid by 1993 graduates if the real rate of tuition continues to grow at its current rate.

29. Note that this figure of 2.5% refers to the growth rate in *starting* salaries (i.e. it is derived from different cohorts of college graduates).
30. The U.S. Department of Education (1991, p. 386) provides earnings information about recent bachelor's degree recipients working full-time during the year following graduation. The earnings equations reported in Table 4 use a sample of full and part-time workers.
31. The Survey of 1985–1986 College Graduates (1987) conducted by U.S. Department of Education is used instead of HSB to calculate the figures reported in Table 11. The advantage of the former is that it contains a far larger number (approximately 12,000) of recent college graduates. This Survey of 1985–1986 College Graduates was not used as the primary dataset in this study because information on high school grades, test scores and other background data were not available. The survey was conducted in April 1987.
32. Presumably, MOSTHIGH graduates have greater ability and wealth than graduates of other colleges. This in turn implies that in order to measure the impact of undergraduate college selectivity on the propensity to enroll in GPS, it is necessary to include several control variables. Fox (1992) estimates a model of GPS enrollment which includes undergradaute selectivity dummy variables. The coefficient of MOSTHIGH is positive and significant in all specifications. However, as college grade point average is included in these regressions, the coefficients of the selectivity dummy variables should be treated with some caution.

REFERENCES

BARRONS' EDUCATIONAL SERIES (1988) *Profiles of American Colleges*. New York: Barrons.

BOISSIERE, M., KNIGHT, J. and SABOT, R. (1985) Earnings, schooling, ability, and cognitive skills. *Am. Econ. Rev.* **75**, 1016–1031.

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

FREEMAN, R. (1975) Overinvestment in college training? *J. Human Resources* **10**, 287–311.

FREEMAN, R. (1975) Legal cobwebs: a recursive model of the market for new lawyers. *Rev. Econ. Stat.* **57**, 171–179.

FREEMAN, R. (1976) A cobweb model of the supply and starting salary of new engineers. *Industrial and Labor Relations Rev.* **29**, 236–246.

GRIFFIN, L. and ALEXANDER, K. (1978) Schooling and socioeconomic attainments: high school and college influences. *Am. J. Sociol.* **84**, 319–347.

HANUSHEK, E.A. (1986) The economics of schooling: production and efficiency in public schools. *J. Econ. Literature* **24**, 1141–1177.

HANUSHEK, E.A. and TAYLOR, L.L. (1990) Alternative assessments of the performance of schools. *J. Human Resources* **25**, 179–201.

HECKMAN, J. (1979) Sample selection bias as a specification error. *Econometrica* **47**, 153–161.

JAMES, E., ALSALAM, N., CONATY, J.C. and TO, D. (1989) College quality and future earnings: where should you send your child to college? *Am. Econ. Rev.* **79**, 247–252.

LANG, K. and KROPP, D. (1986) Human capital versus sorting: the effects of compulsory attendance laws. *Q. J. Econ.* **101**, 609–624.

MARDER, W.D. and WILKE, R.J. (1991) Comparisons of the value of physician time by specialty. In *Regulating Doctor's Fees: Competition, Benefits and Controls under Medicare* (Edited by FRECH, H.E.), pp. 260–281.

MCCONNELL, C. and BRUE, S. (1989) *Contemporary Labor Economics*. New York: McGraw-Hill.

MORGAN, J.N. and DUNCAN, G.J. (1979) College quality and earnings. In *Research in Human Capital and Development*, Vol. 1, pp. 103–121. JAI Press.

PSACHAROPOULOS, G. (1985) Returns to education: a further international update and implications. *J. Human Resources* **20**, 583–604.

SINDELAR, J.L. (1991) Observations on the value of physician work time. In *Regulating Doctor's Fees: Competition, Benefits and Controls under Medicare* (Edited by FRECH, H.E.), pp. 282–287.

SPENCE, M. (1973) Job market signaling. *Q. J. Economics* **87**, 355–374.

U.S. DEPARTMENT OF EDUCATION, CENTER FOR EDUCATION STATISTICS (1986) *High School and Beyond, 1980: Sophomore and Senior Cohort Third Follow-Up*. Washington, DC: U.S. Department of Education. Inter-University Consortium for Political and Social Research no. 8896.

U.S. DEPARTMENT OF EDUCATION, CENTRE FOR EDUCATION STATISTICS (1987) *Survey of 1985–1986 College Graduates*. Washington, DC: U.S. Department of Education.

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U.S. Department of Education, National Center for Education Statistics (1991) *Digest of Education Statistics*. Washington, DC: U.S. Department of Education.
Wales, T. (1973) The effect of college quality on earnings: results from the NBER-Thorndike data. *J. Human Resources* **8**, 306–317.
Weiss, A. (1988) High school graduation, performance, and wages. *J. Political Econ.* **96**, 785–820.
White, H. (1980) A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* **48**, 817–838.
Willis, R. and Rosen, S. (1979) Education and self-selection. *J. Political Econ.* **87**, S7–S36.
Wise, D. (1975) Academic achievement and job performance. *Am. Econ. Rev.* **65**, 350–366.