College Quality and Future Earnings: Where Should You Send Your Child to College?

By ESTELLE JAMES, NABEEL ALSALAM, JOSEPH C. CONATY, AND DUC-LE TO*

In view of the voluminous literature on the returns to quantity of higher education, and the determinants of quality at primary and secondary schools, it is surprising how little work has been done on the causes and consequences of college quality. This paucity of research is due in part to the difficulty in obtaining detailed information about student and institutional characteristics.[1]

In this paper we exploit a uniquely rich data set to answer the questions: Does it matter which college you attend? If it matters, which college characteristics or other aspects of the college experience lead to a higher value-added? The present analysis applies to male college graduates only. (We quickly discovered that a very different process operates for women and this will be explored in a separate paper.)

I. Methodology

As is well known, there are multiple outputs of higher education, including learning, enhancing earnings, value formation, and research. In this paper we concentrate on one output, future earnings, as a function of all the jointly supplied inputs. The inputs are broken down into: X_1, a set of student characteristics denoting family background, ability, and prior academic achievement; X_2, a set of institutional characteristics including college expenditures and student body composition; X_3, a set of higher educational experience variables that are largely controlled by the student; and X_4, a set of labor market variables. We focus on the impact of X_2 and X_3 on earnings, holding X_1 and X_4 constant.

Our information about earnings, X_1 and X_4 comes from the *National Longitudinal Study of the High School Class of 1972* (*NLS-72*). The fifth follow-up of this cohort in 1986 includes 12,841 men and women. We deal in this paper with a subset of this group, the 2280 students, particularly the 1241 males, who had received their college degrees, whose graduating institution was identified, who took at least 60 credit hours in that institution, and who worked for an employer in 1985. Most of them had been out of college for seven to nine years.

Represented in our subsample are 519 colleges and universities. We obtained most of our data about X_2, the characteristics of these institutions, from the *Higher Education General Information Survey* (*HEGIS*) that conducts annual surveys of postsecondary four-year institutions; we chose 1975 as a representative year for our cohort. This was supplemented by data from James Cass and Max Birnbaum (1975). The *Postsecondary Education Transcript Study* (*PETS*) gave us the college transcripts of the students in our sample, from which we derived X_3, the college experience variables. None of the previous studies on college quality have had access to such detailed information about curriculum choices and achievement in college. All financial data were inflated to 1986 prices using the CPI.

We view each *institution* as a set of *characteristics*, X_2, that are experienced uniformly by all students at the college. Poten-

*James is Professor of Economics, SUNY, Stony Brook, NY, 11794. Alsalam, Conaty, and To are Senior Associates at the Office of Research, U.S. Department of Education, Washington, D.C., 20208. This research was supported by the Office of Research's project on Higher Education Productivity. The views in this paper are our own and are not necessarily shared by the Department of Education.

[1]See Ritchie Reed and Herman Miller (1970), Terence Wales (1973), Lewis Solmon and Paul Wachtel (1975), Wachtel (1976), Alexander Astin (1968), Larry Griffin and Karl Alexander (1978), James Morgan and Greg J. Duncan (1979), and Eric Hanushek (1986) for prior work on college equality.

tially one of the most important college characteristics is its expenditure per student. We experimented with a variety of different expenditure variables and ended up using alternatively, the most inclusive measure, educational and general spending per student (ln *EGXPS*) or the most directly relevant measure, instructional expenditures per student (ln *INSXPS*).

We also wanted to investigate whether public vs. private control, institutions with graduate vs. undergraduate missions, and research vs. teaching colleges have different effects on their undergraduates. Private institutions may utilize their resources more efficiently than public or, on the other hand, may have to devote substantial resources to fundraising (see James, 1989). The presence of doctoral students may lead to a diversion of resources away from undergraduates or, conversely, may add a pool of cheap labor available to teach undergraduates. And similarly, research may enhance or detract from the undergraduate teaching function (see James, 1978; James and E. Neuberger, 1981). These possible effects were captured by including private colleges, Ph.D. awarding institutions, and Research Type I universities (Carnegie classification) as dummies (*PRIV*, *PRIV·E*, *PHD*, *RES*) or, alternatively, as interactions with *EGXPS* and *INSXPS*. The total number of *FTE* students (ln *FTE*) was entered, to allow for economies or diseconomies of scale.

We paid particular attention to delineating the composition of the student body because of a substantial literature that indicates that this may affect the learning environment; does it also affect the earning environment? Peer group descriptors that we experimented with were: average SAT score of entering freshmen as an index of institutional selectivity (*SEL*), percent of students who are part-time (which may be a proxy for urban location) (*PPT*), percent of graduating students who are liberal arts majors (*PLIB*), percent of graduate students in total enrollments (*PGRAD*). (For the method used to convert ACT to SAT scale, see Alexander Astin, 1971). We also analyze the individual-institutional matching issue as it pertains to SAT scores, by introducing a quadratic term $SATD = (SAT_i - SEL_j)^2$, which we consider a "college experience" variable. However, beyond that our model assumes that college characteristics have uniform effects on all students, and does not investigate the specific strengths and weaknesses of a college that would benefit some more than others.

While in college the student makes a number of choices concerning major, curriculum, how hard to work to obtain a high GPA, and whether to proceed to a postgraduate degree. These constitute X_3, our *higher educational experience* variables. First, major was entered as 6 dummy variables: Engineering (*ENG*), Education (*ED*), Business (*BUS*), Humanities (*HUM*), Social Science (*SOCSCI*), Math plus Natural Science (*M&SCI*), with "Other" (usually vocational) being the omitted category. Second, we include number of college math credits (*MATHCRD*) and third, we introduce the college GPA as an independent variable. Postgraduate degree (*POSTGRAD*) is our final "higher educational experience" variable, which is expected to have a positive effect.

Our *student background* controls, X_1, include race, religion, parental income, number of siblings, father's education, and father's occupational status. Our prior academic achievement variables include dummies for attendence at Catholic high schools, academic track, semesters of math in high school, size of graduating class, percentile rank in high school, high school grade point, and individual's verbal plus mathematics SAT scores or a transformation of ACT scores onto an SAT scale.

A substantial literature documents the fact that family background and prior academic achievement strongly influence future earnings, much of this operating through choice of college and impact on probability of completing college. We would expect background effects to be smaller in this study, where everyone has a college degree and characteristics of the college are explicitly included. Multicollinearity may be present; however, our purpose is not to estimate the separate background effects but to make sure that we do not overestimate the college effects.

While our focus is on undergraduate education, we control for a host of *labor market* variables, X_4, that influence earnings: months of employment experience since 1977, years since degree, tenure on current job, hours and weeks worked in 1985, part-time employment, military service since BA, and public employment. Marital status and number of children in 1985 were included as variables that might influence unobservable labor market choices such as effort. In some equations we include a set of occupational and industry dummies.

We use weighted least squares as a descriptive tool during this more exploratory stage of our research. However, it has limitations that should be recognized. These affect the interpretation of both the coefficients and the standard errors.

First, a study of this sort cannot completely avoid the possibility of selection bias in estimating coefficients. Students with unobservable characteristics (such as motivation) may work harder, enter remunerative majors and occupations, and also self-select themselves into certain colleges, thereby creating the appearance of large college effects when in fact they may be small. We have tried to minimize this problem by controlling for numerous student characteristics and also by controlling, in some equations, for college experience variables such as major and GPA that may proxy the unobserved student characteristics. These equations may help to mitigate selection bias at the college level but the problem recurs at the curriculum level: Are the effects of GPA, math and major real effects, or are they, too, due to unobserved student characteristics that are correlated with these choices?

There are also problems with regard to the estimation of the standard errors of the estimates. For instance, if there are unobserved fixed college components in the error, then the variance-covariance matrix of the errors is nondiagonal, least squares estimates of the standard errors may be underestimated and significance levels overestimated. A similar effect may stem from the *NLS-72* sample design, which is a multistage cluster sample with nonuniform selection probabilities. Despite these limitations, we believe that a clear picture does emerge of the impact of college characteristics and college experience variables.

II. Results

We started with a basic model (equation 1) that predicts 1985 annual earnings with a small number of key variables from each category, in an attempt to replicate the models that were tested earlier by Wachtel, Solmon-Wachtel, Wales, and Reed-Miller. (The expenditure variable is *EGXPS*; we found that *INSXPS* yielded a very similar picture.) Indeed, we obtained significant college effects, as they did, and with approximately the same explanatory power.

We then added a much broader set of institutional characteristics to see if this increased the explanatory power of the model or changed key arguments. Equation 2 was expected to provide the largest college effects, which it did. Equation 3 added a long list of student background and prior achievement variables. Equation 4 entered "higher educational experience" as a set of independent variables. Equation 5 added key labor market variables, particularly weeks worked per year and hours worked per week, that dramatically increased the explanatory power of the model. Finally, equation 6 added the occupation and industry dummies as exogenous variables. When all the variables were included, we were able to explain almost half the variance in earnings of this cohort of male college graduates. Equations 3, 5, and 6 are presented in Table 1. (For full results and discussion, see James et al.)

Regardless of which variables are in the model, measured *college effects* are small, explaining 1–2 percent of the variance in earnings. Interestingly, these effects are largely unchanged when controls for family background and prior academic background are added in equation 3, although they decline when major and even more so, when occupation, are added in equations 4, 5, and 6.

To the extent that college characteristics matter, selectivity and Private-East ($PRIV \cdot E$), characteristics that are not readily replicable, seem most important. With

TABLE 1—ANNUAL EARNINGS REGRESSIONS, 1985

	(3)	(5)	(6)
College Characteristics:			
ln *EGXPS*	.0165	−.0005	−.0102
	(.0625)	(.0535)	(.0518)
SEL/100	.0438[b]	.0326[c]	.0198
	(.0214)	(.0182)	(.0176)
ln *FTE*	.0786[b]	.0297	.00932
	(.0327)	(.0281)	(.0272)
PRIV	−.0595	−.0433	−.0452
	(.0595)	(.0514)	(.0498)
PRIV·E	.133[b]	.100[c]	.092[c]
	(.0653)	(.0565)	(.0545)
PHD	−.0433	−.0469	−.0385
	(.0524)	(.0454)	(.0441)
ln *EGXPS·RES*/10	−.101[c]	−.0396	−.008
	(.0609)	(.0519)	(.0502)
Higher Education Experience:			
GPA		.0932[b]	.0826[b]
		(.0377)	(.0368)
BUS		.096[b]	.0432
		(.0401)	(.0460)
ED		−.166[a]	−.102[c]
		(.0512)	(.0596)
ENG		.304[a]	.349[a]
		(.0571)	(.0749)
HUM		−.107	−.128
		(.0829)	(.0800)
SOC SCI		.0718	.0809[c]
		(.0444)	(.0429)
M&SCI		.0306	.0178
		(.0508)	(.0496)
MATHCRD/10		.041[b]	.0215
		(.0163)	(.0161)
POSTGRAD	.102[b]	.0923[b]	.102[a]
	(.0425)	(.0372)	(.0368)
R^2			
Model	.179	.421	.476
College Char.	.017[a]	.008[c]	.004
Higher Ed. Exp.		.052[a]	.029[a]
Background	.036[a]	.019[a]	.011[b]

Note: Standard errors reported in parentheses. See text for individual characteristics controlled in all 3 equations and for labor market variables included in equations 5 and 6. Other variables included in all three equations are *PPT*, *PGRAD*, *PLIB*, *SATD*, and dummy variables to indicate missing values for some variables.

[a, b, c] significant at .01, .05, and .10 levels, respectively.

the exception of equation 6, the average SAT score of the freshman class has a significant positive effect—a 100 point increase raises annual earnings about 3 percent. This holds regardless of the individual's SAT; that is, academic mismatching does not seem to be a big problem. Private institutions in the East (that are relatively more elite than those in the rest of the country) also have a large advantage, of about 5 percent, relative to public institutions, even after occupation is added.

Variables related to prestige and selectivity may influence earnings in several ways: through the peer group effect they may raise the amount of learning that goes on at the institution; and they may serve as informational signals to employers about the probable aptitude of individual students. Also, students from more prestigious institutions may benefit from their contacts and halo effect, and these institutions may channel their students into remunerative majors and occupations (or into high-wage locations for which we were unable to control). To the degree that these effects are simply distributional rather than positive sum, the private returns we are measuring will exceed the social returns.

In contrast, expenditure per student (*EGXPS*) actually has a negative sign in most cases, but its coefficient is very small and never close to significance, regardless of which other institutional variables are in the model. This contradicts Wachtel's earlier finding about colleges but is consistent with Duncan-Morgan, and with much of the literature on primary and secondary school effectiveness. According to the experience of males in the *NLS-72* cohort, attending a higher-spending college is not the way to increase future earnings and a higher *EGXPS* does not imply higher future productivity.

We thought the lack of a significant relationship might be due to the fact that most high-spending institutions are selective and are, furthermore, universities that allocate much of their resources to graduate programs and research. To test these possibilities, we tried specifications in which we omitted *SEL* and interacted *EGXPS* with *PHD* and *RES*. The interaction terms were indeed negative, and the main effect (applying to undergraduate colleges) became positive, but still insignificant. The *PHD* and *PGRAD* dummies were also insignificantly negative. All of these small negative effects tend to be cancelled out by the larger size of graduate institutions (that has a positive effect). The main conclusion to be drawn is that research and graduate programs do not help undergraduates, nor does the choice between college vs. university affect future earnings. Similarly, private control outside

of the East has a negative effect but its standard error is too large to allow us to use this for predictive purposes; the private sector is very diverse. (Undoubtably there are other, unobserved, college effects as well; we plan to measure their extent using a variance components model, subsequently.)

In sum, if the objective is to maximize future earnings, it appears one should choose a selective private eastern college, but the proportion of variance explained by these characteristics is small and the impact on future productivity is probably smaller yet.

While institutional characteristics do not explain a large proportion of the variance in earnings, other aspects of the *higher educational experience* such as choice of major, number of maths credits taken, GPA, and postgraduate degree matter a great deal. All of these variables are highly significant, add substantially to the R^2 of the model, and, as a group, explain 3 to 5 percent of the variance in equations 4, 5, and 6. The importance of college experience was also found by David Wise (1975).

For example, students with a higher GPA have higher expected earnings, and this effect remains even when occupation is controlled in equation 6. When GPA increases from C to B or from B to A, annual earnings rise about 9 percent. While GPA indicates, in part, that students have acquired specific knowledge, we think of it additionally as a proxy for general human capital characteristics such as ability and habits of discipline and perseverance. There are also large positive returns to high school and college math, although these decline when occupation is introduced, suggesting that more specific skills are involved.

We wondered which majors are worth more in the marketplace—those imparting vocational or cognitive (liberal arts) skills. It turns out that neither has a decided advantage. Within the liberal arts group, Humanities students earn about 10 percent less than our omitted (mostly vocational) category, Natural Science and Social Science students earn 3 to 8 percent more, effects that are usually not significant. Within the vocational group, Business and Engineering receive large positive returns of 10 and 30 percent, respectively, but Education a large negative return of about 15 percent, all significant effects.

Is this a return to the major or to the narrow occupation for which it is preparing people? When we add occupation in equation 6, we find that Engineering majors receive the same high wages whether or not they function as engineers. Education majors receive a low wage whether or not they function as teachers, but their wage is especially low if they become teachers. In both cases, training imparted by the major (or unobserved characteristics of individuals attracted to the major) have the same influence on earnings over a broad set of occupational choices. But Business majors receive high wages if and only if they function as managers; the apparent high return to the major is really a high return to the specific occupation which many, but not all, will enter. These differential returns to majors are analyzed from the viewpoint of social efficiency and educational policy in a separate paper.

III. Conclusion

In this paper we have analyzed the value-added to future earnings, a proxy for future labor market productivity, and we have sought to identify those college characteristics that create this aspect of quality. We would like to emphasize three points.

First, it appears that institutional characteristics such as selectivity and Private-East have positive effects on future earnings. Expenditures per student, on the other hand, have no such impact. This sets up a possible contradiction between private and public benefits. Paying the higher tuition charged by the more selective private eastern institutions was a good private investment in 1975, enabling them to increase their price during the next decade. At the same time, if colleges used this income to raise their *EGXPS*, there was no commensurate social productivity gain. This paper has focused on private benefits; implications for social benefits will be explored subsequently.

Second, while sending your child to Harvard appears to be a good investment, sending him to your local state university to major in Engineering, to take lots of math,

and preferably to attain a high GPA, is an even better private investment. Apparently, what matters most is not which college you attend but what you do while you are there, a finding that has important and, we believe, encouraging implications for educational and social policy. In fact, these college experience variables explain more of the variance than measured family background, ability, and college characteristics combined.

Third, we must recall that students, parents, and society care about many outputs of higher education besides future earnings and productivity. These include learning, research and value formation. We intend in future studies to examine these other outputs, as well as further topics that were suggested by this analysis, such as the selectivity bias that may be influencing our results, college-student interactions, choice of major and occupation, the male-female wage differential, and the determinants of expenditures, selectivity, and other college characteristics.

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