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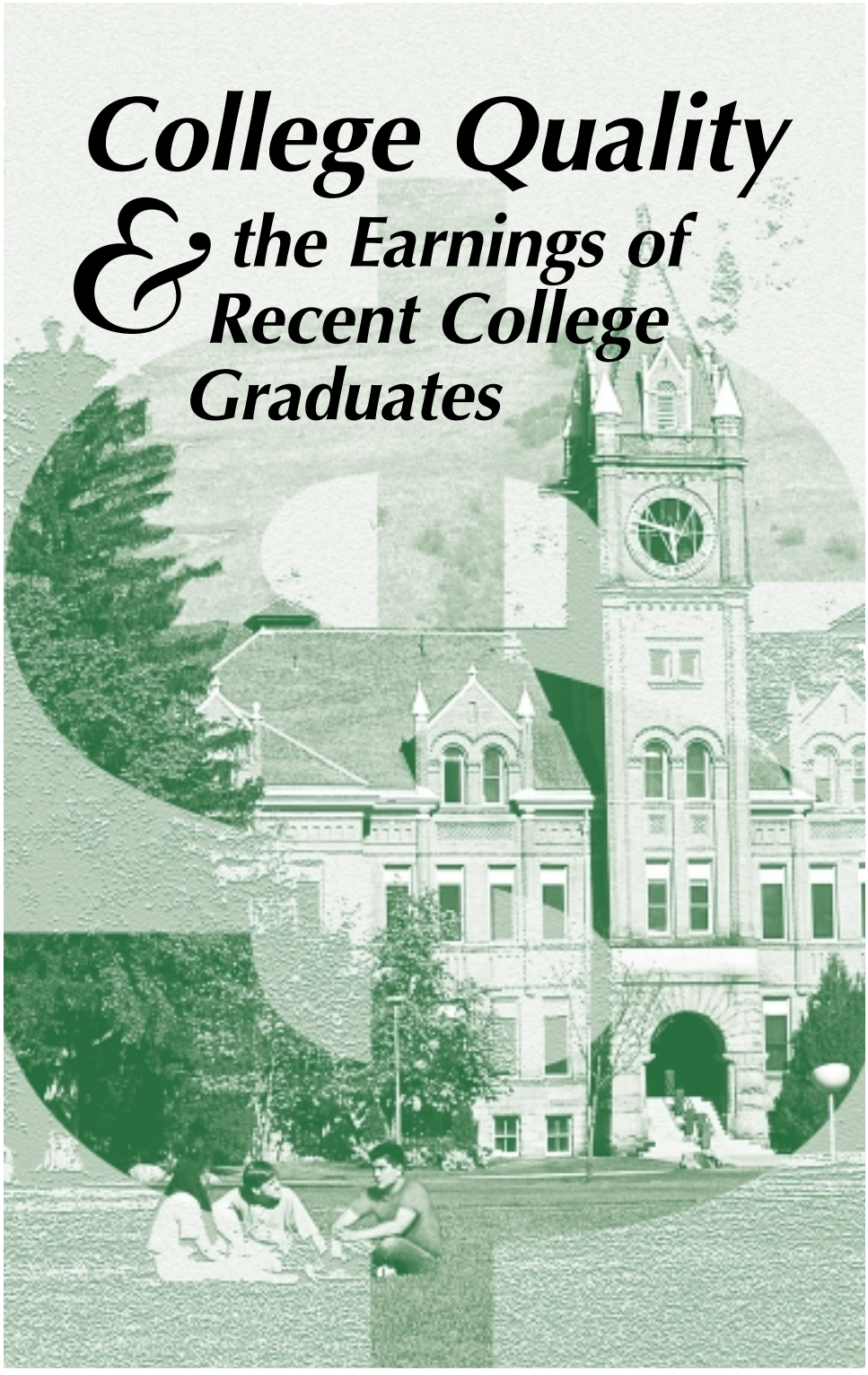
Research and Development Report August 2000

College Quality & the Earnings of Recent College Graduates



U.S. Department of Education
Office of Educational Research and Improvement NCES 2000–043

NATIONAL CENTER FOR EDUCATION STATISTICS

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College Quality and the Earnings of Recent College Graduates

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U.S. Department of Education **NCES 2000–043**
Office of Educational Research Improvement

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Foreword

The Research and Development (R&D) series of the reports has been initiated:

- To share studies and research that are developmental in nature. The results of such studies may be revised as the work continues and additional data become available.
- To share results of studies that are, to some extent, on the "cutting edge" of methodological developments. Emerging analytical approaches and new computer software development often permits new, and sometimes controversial, analysis to be done. By participating in "frontier research," we hope to contribute to the resolution of issues and improved analysis.
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The common theme in all three goals is that these reports present results or discussions that do not reach definitive conclusions at this point in time, either because the data are tentative, the methodology is new and developing, or the topic is one on which there are divergent views. Therefore, the techniques and inferences made from the data are tentative and are subject to revision. To facilitate the process of closure on the issues, we invite comment, criticism, and alternatives to what we have done. Such responses should be directed to:

Marilyn M. McMillen
Chief Statistician
Statistical Standards Program
National Center for Education Statistics
1990 K Street NW
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Executive Summary

This report examines the association between factors such as selectivity and other institutional characteristics, and the earnings of recent college graduates 5 years after graduation. The report addresses a number of questions of interest to students who are deciding which college to attend, as well as to their parents and institutional and government policymakers. These questions include the following:

- Are the earnings of recent graduates associated with the characteristics of the colleges and universities from which they graduated?
- Is where a student went to college more or less important for earnings than the choices he or she made while enrolled about how much effort to expend on studies or which field to major in?
- If some institutional characteristics are associated with higher earnings, which ones are they? Are larger colleges better than smaller ones? Are more selective colleges associated with higher earnings? How much does it matter whether the institution's mission is research or teaching?
- Are institutional effects on earnings the same for women as they are for men, or do these effects vary systematically by sex?

To address these issues, data from the 1980 High School and Beyond (HS&B) study were combined with information about courses, grades, credits, and credentials contained in the Postsecondary Education Transcript Study (PETS), a comprehensive source of information about the postsecondary experiences of the 1980 HS&B Sophomore Cohort. Information about the colleges 1980 sophomores attended came from the Integrated Postsecondary Education Data System (IPEDS), which contains information on enrollment, finances, institutional characteristics, and degrees awarded. In addition, information from the College Board's Annual Survey of Colleges was also included. The combination of longitudinal data, postsecondary transcripts, and institutional data provided a rich and unique source of information with which to explore the research questions.

A series of statistical analyses were performed that permitted assessing the net effect of college characteristics on 1991 annual earnings controlling for differences in student background, labor market characteristics, and higher education experiences, such as grade-point average and major field of study. The results were examined in two ways. First, the contribution of college

characteristics to explaining variance in earnings among college graduates (incremental R^2), and second, the estimated dollar effects over the course of a working life.

Overall, the net contribution of college characteristics to variance in men's earnings was relatively small, ranging from 2 to 3 percent, somewhat less than the net effect of background characteristics on earnings. Higher education experiences accounted for substantially more variance in men's earnings than either college characteristics or background characteristics (about 12 percent).

A different picture emerged for women. Institutional characteristics explained more of the variance in female earnings than they did in male earnings. The incremental R^2 for women ranged from 4 to 6 percent after controlling for background characteristics, labor market characteristics, and higher education experiences.

For both men and women, choice of major was associated with later earnings. The results suggest that the primary mechanism linking major field of study and earnings was the association between major and occupation. For men, adding occupation and industry reduced the explained variance attributable to higher education experiences from 12 percent to just over 4 percent, while the variance accounted for by institutional characteristics remained at 2 percent. For women, however, the pattern was somewhat different. Unlike men, for whom the variance associated with higher education experiences was almost six times as large as institutional characteristics (12 percent versus 2 percent), institutional characteristics were almost equally important in affecting earnings (5 percent versus 4 percent). After including information about occupation and industry, the explained variance attributable to higher education experiences fell from 6 to 3 percent. Institutional characteristics still explained about 4 percent of the variance in women's earnings.

Among the college characteristics that mattered for men were attending a selective versus a nonselective institution. Obtaining a degree from a selective institution (measured by the Cooperative Institutional Research Project rating for colleges and universities) was associated with an earnings increment of 11 to 16 percent. Men also benefited from attending institutions with higher per capita spending on instruction.

For women, selectivity (measured by the ratio of applicants to admissions) was associated with higher earnings. A unit increase in this ratio was associated with about a 12 percent increase in earnings. Attending a selective liberal arts college, and attending an institution located in the mid-Atlantic region or New England also had significant positive effects on women's earnings.

Although college characteristics appeared to account for a relatively small proportion of the total variance in earnings for men, and somewhat more but still relatively little for women, they were nonetheless quite important. For men, attending a college whose characteristics were one standard deviation above the average was estimated to be worth an additional $2,311 in annual earnings, or an 8.1 percent increase above the average of $28,567. For women, the comparable increment was $3,746, or a 17.4 percent increase above the average of $21,590. These effects are comparable to the estimated effect of attending an additional year of college.

The results of these analyses should offer some consolation to students and their families as they sit down to decide where to attend college. Although differences among colleges can have a large effect on lifetime earnings, decisions that students make regardless of which college they attend (especially major field of study) have substantial effects on later labor market outcomes. From this perspective, students may choose to avail themselves of the least expensive alternative that provides the major in which they are interested.

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Preface

This report on college quality and the earnings of a recent cohort of college graduates is particularly timely. Students, parents, college administrators, and state and federal policymakers have expressed concern over the rising costs of a college education. *The Condition of Education 1997* reported that tuition and fees (in constant dollars) at public universities increased from about $1,700 to $3,200 between 1981 and 1995. During that same period, tuition and fees at private universities increased from $8,100 to $15,800.[1] Institutional expenditures for instruction per full-time equivalent (FTE) student increased from $6,000 to $6,800 between 1981 and 1994 at public universities, and from $9,300 to $14,000 per FTE student at private universities.[2] Although tuition is only part of the cost of attendance, and grant aid and other forms of financial aid help offset some of the cost students and their families incur, many people are concerned about whether college costs are out of balance with the benefits provided by a college degree.

College education in this country is provided by a diverse set of public and private institutions, encompassing public and private, not-for-profit 4-year colleges and universities. Does it matter where one attends college? Are private colleges and universities more efficient than public institutions in providing educational benefits, or is what students do while attending college more important in affecting their earnings after college?

Students differ in their backgrounds and abilities, and these differences may affect their choice of postsecondary institution. They differ, too, in what they study, and whether they continue their education in graduate or professional programs. After college, students enter different occupations. All these factors influence earnings directly or indirectly, and it becomes difficult to separate the effects of college characteristics from these other factors affecting the earnings of recent college graduates.

The statistical models in this report attempt to reflect the complexity of the earnings process. They incorporate controls for family background and high school academic experiences such as parental income, race/ethnicity, high school grade point average (GPA), cognitive ability, and so on that occur prior to college, and labor market factors such as general and specific labor

[1]The increase in tuition and fees at other public 4-year institutions increased from about $1,400 to $2,700 between 1981 and 1995, and from $6,400 to $11,500 at other private, 4-year institutions (U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1997,* Supplemental table 12–3).

[2]Amounts are in constant dollars (*The Condition of Education 1997,* 174).

market experience, occupation, and industry that occur after college. Detailed information from the postsecondary transcripts is used to document the decisions students make about their education, including the kinds of courses they take, major field of study, college GPA, and postgraduate education. Finally, the effects of institutional characteristics—the factors that contribute to an institution's "quality"—are assessed net of differences in student background, labor market situation, and higher education experiences.

This report addresses these issues by estimating a series of multiple regression models using data from several sources. Information about students' family background and precollegiate academic experiences comes from the High School and Beyond (HS&B) survey of 1980 high school sophomores. Information about the postsecondary education experiences of these students comes from the Postsecondary Education Transcript Study (PETS). The PETS data are a particularly rich source of information on courses, credits, major field of study, and postsecondary attainment. To complement the richness of the individual data, information about the postsecondary institutions attended by the 1980 sophomores was obtained from the Integrated Postsecondary Education Data System (IPEDS), which contains information about institutional finance, staffing, and enrollment. Supplementing these data were items from the College Board's Annual Survey of Colleges.

The results of these analyses assess the contribution of institutional characteristics to early career earnings in several ways, including the overall net contribution to explained variance (R^2) and the dollar increment in earnings attributable to institutional characteristics. The latter approach is somewhat tentative and exploratory and thus fits well with the purpose of the National Center for Education Statistics' (NCES) Research and Development (R&D) series of reports.

Acknowledgments

A joint collaborator on this report was Nabeel Alsalam. He conceived the analysis plan for the report, provided guidance at critical stages in the analysis, and wrote selected sections of the report that provided an interpretation of the overall results of the analysis. Under normal circumstances, he would be listed on the title page as a second author. However, before the report was completed, he moved from the National Center for Education Statistics to the Congressional Budget Office.

Shelley Burns, who oversaw the final adjudication and publication of the report, was gracious in her support of this research. Under her direction, the final technical review and adjudication processes were completed and the report prepared for print and Internet access.

MPR Associates, Inc. provided the research, programming, and editorial staff without whom this project could not have been completed. Thanks are gratefully extended to Ellen Liebman who prepared the analysis files and to Barbara Kridl, Mary Mack, Andrea Livingston, and Karyn Madden who were responsible for the editing and final layout. Leslie Retallick prepared the cover artwork.

The comments of reviewers inside and outside the U.S. Department of Education were exceptionally insightful and helpful. Among the external reviewers, we wish to thank Ellen Bradburn of NCES, Dominic Brewer of the RAND Corporation, and Professor Robert Trost of George Washington University for valuable suggestions about a variety of technical and substantive
issues.

The report benefited greatly from the comments of readers within the U.S. Department of Education, including David Boesel and John Wirt of OERI, Kristin Perry of NCES, and Pat Scheer of the Office for Civil Rights. Special thanks are due to Marilyn McMillen, NCES Chief Statistician, who chaired the adjudication panel.

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Introduction

The positive relationship between completion of a bachelor's degree and average annual earnings has been well established. Furthermore, it is well known that the strength of this relationship has become stronger in recent years (Murphy and Welch 1989). For example, in 1996, males 25–34 years old earned 54 percent more than their counterparts whose formal education ended with high school. In contrast, this premium was only 14 percent in 1974 (*The Condition of Education 1998*.) Despite the high average premium to finishing college, there is much variation in this premium. Two sources of this variation are the *quality* of the college a student attends and the *field* the student chooses to study. This report describes the contribution of college quality, controlling for field of study and other factors, to variance in annual earnings for college graduates five years after graduation.

Early research on the issue of college quality considered an institution's *selectivity* (measured by the average SAT score of its freshman class) to be an indicator of its quality. As Karabel and Astin (1975) put it, "[s]electivity . . . is probably the best single measure of prestige in that it indicates a school's capacity to attract students of high ability." Most research has found selectivity to be a small, yet significant, predictor of earnings, while controlling for individual-level variables such as family background, socioeconomic status (SES), ability, and high school performance (Karabel and Astin 1975; Trusheim and Crouse 1981; Mueller 1988).

James et al. (1989) extended the analyses of college quality using data from the 1972 National Longitudinal Survey of High School Seniors (NLS–72) in two ways. First, the researchers controlled for higher education experiences (i.e., choices made by students with respect to academic effort and college major) and labor market experiences (i.e., occupation, job training, and years of experience). Second, they broadened the definition of "college quality" to include a variety of institutional characteristics besides selectivity. These included institutional control (private versus public); institutional mission (research versus teaching); composition of the student body (e.g., the percentage of graduate students and peer group proxies such as selectivity); and expenditures per student. Finally, as a measure of "college experience," they considered the effect of institutional mismatching, which is the difference between the average SAT score of entering freshmen and the individual. They found that although "college quality" had an independent effect on earnings, individual-level higher education experience variables including major, grade point average (GPA), and the number of college mathematics credits explained more of the

variance in male students' earnings than did institutional characteristics such as selectivity and the interaction of private university and Eastern region. The researchers concluded that " . . . what matters most is not which college you attend but what you do while you are there . . . " (James et al. 1989, 252).

Any empirical investigation of the relationship between educational attainment and earnings in the labor market is confronted with the problem that unobserved characteristics of individuals that are related to higher educational attainment may also be associated with higher earnings. As a result, a part of the observed relationship between educational attainment and earnings may be due to these other unobserved characteristics. Recent research has taken steps to account for these characteristics. In two studies, Brewer, Eide, and Ehrenberg (1996; 1999) explicitly modeled a student's choice of the type of institution attended using variables such as the net cost of attending different institutions and student background characteristics. After including controls for the factors influencing students' decisions about the type of college to attend, Brewer, Eide, and Ehrenberg (1999, 104) found "a significant economic effect to attending an elite private institution, and some evidence . . . this premium has increased over time." The sample used by Brewer and his colleagues included the NLS–72 data that James et al. had used and the 1980 High School and Beyond (HS&B) Senior and Sophomore Cohorts that graduated 8 years and 10 years, respectively, after the NLS–72 cohort.

It is well known that graduates in certain fields have substantially higher salaries than those in other fields. Rumberger and Thomas (1993) investigated the economic return to college major and found that the effect of institutional quality was not uniform for students in different majors. For example, the starting salaries of engineering majors did not vary across institutions, while they did for other majors. Grogger and Eide (1995, 280) found that "the trend away from low-skill subjects such as education and toward high-skill subjects such as engineering accounts for one-fourth of the rise in the male college wage premium." Their research used both the NLS–72 and the 1980 HS&B Senior Cohort.

Other research points out that inequality in wages has been rising since 1969 *within* groups of workers and varies by gender, race, age, and *education* (Katz and Murphy 1992). Although there are many possible sources for this increase in inequality (Levy and Murnane 1992), one analysis (Murnane, Willett, and Levy 1995) suggests that the impact of cognitive skills increased between 1978 and 1986. The increase in returns to cognitive ability for women, for example, was large enough to account for all the earnings increase associated with postsecondary education. Murname, Willett, and Levy's sample was also based on both the NLS–72 and HS&B cohorts.

It is evident that the conclusion of James et al. (1989), which applied to 1972 high school graduates who earned bachelor's degrees, may not hold for the cohort of graduates who came a decade later. Over that decade, the premium for attending an elite private institution may have increased, and college students moved toward high-skill majors. Wage inequality increased, and this inequality is partly associated with a higher return to cognitive skills.

This report examines whether or not the findings of James et al. (1989) account for the earnings of a more recent cohort of 4-year college graduates drawn from the 1980 HS&B study. Among the issues addressed here are the following:

- What was the effect of college quality on the 1991 earnings of 1980 high school sophomores who received a bachelor's degree in the mid-1980s?
- Did the choices that students made in college about what to study (i.e., "college experiences") have a greater effect on their earnings than the characteristics of the school they attended?
- If some college characteristics are associated with higher earnings, which characteristics are these? Are larger schools able to provide a richer and more varied experience than smaller schools, which, in turn, translates into higher earnings for their graduates? Is attendance at a highly selective school associated with higher earnings? How does a college's mission, research or teaching, affect graduates' earnings?
- Does college quality affect the earnings of men and women graduates equally, or do these effects vary systematically by sex?

To address these issues, data from a national sample of high school students who earned a bachelor's degree in the mid-1980s were used.

The HS&B Fourth Follow-up Survey and the HS&B Postsecondary Education Transcript Study (PETS) provide a unique combination of data about a nationally representative sample of 1980 high school sophomores.[3] The PETS data contain detailed information about the colleges that 1980 sophomores attended after high school, the courses they took, and their grades, majors, and degree attainment. The HS&B Fourth Follow-up Survey, conducted in 1992, complements the information about postsecondary studies provided in the PETS survey with information about various labor market outcomes including occupation, industry, employment and unemployment, and annual earnings. Moreover, the HS&B Base Year and succeeding follow-up surveys collected detailed information about students' high school coursework, aspirations, family background, and a variety of demographic characteristics that allow statistical controls for family and high school background. In addition to these data sources, information about the colleges and universities attended by the 1980 sophomores was obtained from the Education Department's

[3]Appendix A contains a complete description of the HS&B surveys used in this study.

Integrated Postsecondary Education Data System (IPEDS), supplemented with information from the College Board's Annual Survey of Colleges.[4]

[4]See appendix A for a description of these two sources of institutional information.

Model and Methods

The dependent variable in this study is earnings. Although there are many other outputs of postsecondary education (e.g., the development of cultural, ethical, and aesthetic values, and so on), many students and their parents are hopeful that at the end of college lies a well-paid job. For some students and parents, there are perceived advantages associated with attending a "high-quality" school, advantages that affect their willingness to pay substantial tuition and fees or to enter into long-term debt.

Earnings outcomes are contingent on a variety of factors not directly attributable to the characteristics of the college a student attends. Students enter college and the work force with different endowments of human capital, some of which are formed in the family, and some gained in high school and earlier schooling. Decisions that students make about their college education, such as the amount of effort expended to acquire knowledge and mastery of a specialized field of study, may also affect later earnings. Students differ in their motivation and cognitive ability, and these differences are likely to affect their job performance and earnings. In addition, labor market factors, such as occupation, industry, and the amount of employment or unemployment, also affect earnings.

The earnings models used in this report attempted to reflect this complexity. These models included four sets of variables corresponding to four possible sources of variance in earnings: family background and pre-collegiate education, college characteristics, postsecondary education experiences, and labor market factors.

Individual demographic characteristics (race–ethnicity, gender, and so on); family background measures (income and socioeconomic status); and high school academic achievement (high school grades, cognitive skills) represent sources of human capital formed in the family and in high school.

Institutional characteristics may be experienced uniformly by students, and they may contribute to the institution's overall "quality." The term "college quality" is used in this report to describe characteristics of colleges and universities that provide an increment to student earnings net of the effects of pre-collegiate academic and social background factors, student experiences in college (like choice of major), and post-collegiate labor market factors such as occupation and industry. Among the potential college quality characteristics are indicators of institutional

resources allocated to instruction, admissions selectivity, student/faculty ratio, and institutional mission (research versus teaching).

Each student made choices or had experiences while enrolled that influenced later outcomes such as occupation and earnings. Some students worked hard at their studies, while others concentrated on the social aspects of college life, athletics, or community activities. These factors were reflected in the amount of effort and ability expended on studies (as measured by GPA), the choice of major and its difficulty, the number of mathematics courses taken, and so on. Whether these decisions were independent of institutional characteristics or were partially determined by them is discussed below. Analytically they are treated separately because students believe they are personal decisions. For ease of exposition, as well as to emphasize the difference between effects associated with institutional characteristics and effects influenced by student choice, the two groups of variables were included in the models separately.

Occupation, industry, general and specific work experience, and the amount of employment and unemployment were obvious sources of differences in earnings, so they were included as control variables in order to assess the relative contribution of college characteristics.

Following the approach used by James et al. (1989), variations of the following model were estimated:

$$Y_i=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\varepsilon$$

where

Y_i = natural log of 1991 annual earnings

X_1 = variables reflecting individual demographic, family, and high school characteristics

X_2 = college characteristics, including factors like institutional control, institutional mission (research or teaching), instructional expenditures, faculty/student ratio, and selectivity

X_3 = higher education experience variables, including GPA, major, the number of credits in college mathematics at the level of calculus or above, the year the bachelor's degree was awarded, and participation in postgraduate studies

X_4 = labor market variables including work experience, occupation, industry, and the number of months of employment

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4,$ = are unknown coefficient vectors

ε = a normally distributed error term with mean zero and constant variance

The regression models were estimated separately for men and women using weighted least squares (WLS) regression. The coefficients for the variables included in X_2 and X_3 are the

primary focus of the analysis, since they show the effect on earnings of institutional characteristics associated with "college quality," and the choices students made about their college experiences ("higher education experiences"). Both sets of college factors were evaluated controlling for differences in students' background before college (X_1) and labor market factors after college (X_4) that also affected earnings.

Estimation

Undoubtedly, there are many characteristics of individuals included in this study that have not been measured but were important determinants of their annual earnings in 1991. These characteristics may be intangible ones such as motivation and drive or tangible ones such as related work experience. As a result, the earnings models presented below account for under half of the total variability in earnings. The purpose of this research, however, is not to account for all or even most of the variability in earnings. Rather, this research attempts to estimate how much of the variability in earnings is associated with the characteristics of the undergraduate institution a person graduated from and the effects of factors such as major field of study and grade point average. Unfortunately, some unmeasured factors may be positively associated both with annual earnings and, for example, institutional selectivity, so the estimates of the association between selectivity and earnings may be overstated. This circumstance, often caused by the omission of relevant variables, may have occurred if highly motivated individuals competed more vigorously to be admitted than their less motivated but equally talented peers, and, consequently, were more than proportionately represented at selective institutions.

There are sophisticated statistical procedures available to minimize possible bias in the regression coefficients for earnings models due to omitted variables. However, these procedures require either further assumptions about the process of annual earnings determination or a fortuitous natural experiment. Further, while unobserved personal characteristics may affect the size of estimated coefficients, there is some evidence that the fundamental conclusions reached about the relationship between college characteristics and later earnings do not differ in the corrected and uncorrected models.

Among the researchers who have attempted to control for omitted variables, Brewer, Eide, and Ehrenberg (1999) explicitly modeled high school students' choice of college type (defined by three categories of selectivity and public or private control). Their results suggest that omitted variables associated with school choice were somewhat important in affecting estimates of the relationship between college quality and earnings. The coefficient for the correction factor was statistically significant in seven of 30 models (six college choices by five wage or earnings outcomes). However, their basic result of a significant effect associated with attending an elite

private institution was evident whether or not the decision to attend an elite institution was explicitly accounted for.

An alternative approach to correcting for possible omitted variables is the method of instrumental variables. An instrumental variable is a variable that is correlated with the independent variable affected by the endogeneity problem but not with the omitted or unmeasured variables that affect the dependent variable. To guard against bias due to the correlation between unobserved student characteristics (such as ambition) and observed college characteristics (such as selectivity and expenditures per student), James and Alsalam (1993) used instruments for institutional selectivity and institutional expenditures per student. Doing so did not change the authors' conclusion that institutional selectivity was statistically insignificant when labor market and higher education experience variables were included in the earnings regression (126).

While employing corrections for omitted variables is beyond the scope of this report, warnings about the possible existence of omitted variable bias and results from other researchers' attempts to adjust for it are provided at appropriate points in the discussion.

Data Sources and Sample

The sample consists of all 1980 High School and Beyond (HS&B) sophomores who had complete postsecondary transcript information, had earned a bachelor's degree by 1990, were not enrolled in graduate school in 1991, and had positive earnings in that year.[5] The HS&B Postsecondary Education Transcript Study (PETS) was the source of information about attainment and course taking. The final sample consisted of 2,360 college graduates, 1,232 females and 1,128 males. Since the original HS&B sample included disproportionately more students who were black, non-Hispanic, who attended parochial and other private schools, and so on, weights that corrected for the disproportionate sampling and for nonresponse bias were used in this study.

The means for each variable used in the models are shown in table 1.

[5]About 16 percent of the sample began their studies at a community college, but everyone in the sample earned a bachelor's degree at a 4-year college or university.

Table 1—Means for variables used in the regression models, by sex

	Male	Female
Institutional characteristics		
CIRP Selectivity (reference = "non-selective")*		
CIRP highly selective	0.05	0.04
CIRP selective	0.18	0.17
FTE/faculty ratio	22.06	22.22
Ratio of applicants to acceptances	1.59	1.54
Natural log total FTE enrollment	8.93	8.89
Percent of total FTE who were graduate students	12.84	12.42
Control of school is private, not-for-profit	0.31	0.29
School located in Mid-Atlantic/New England	0.28	0.26
Carnegie Classification	0.23	0.19
Carnegie class research university I		
Carnegie class research university II	0.11	0.09
Carnegie class liberal arts college I	0.04	0.04
Private, not-for-profit research university I	0.04	0.03
Private, not-for-profit research university II	0.01	0.01
Per capita (FTE) expenditure on instruction	$4,180	$4,126
Per capita (FTE) expenditure on student services	$654	$611
Historically black college or university	0.01	0.03
Higher education experiences		
GPA (on 4-point scale)	2.84	2.92
Credits in calculus/calculus-based courses	1.57	0.71
Course-taking diversity	13.12	13.58
Number of community college credits	9.26	9.14
Major field of study (reference = business)		
Education or library sciences	0.02	0.10
Engineering, architecture, or engineering technology	0.19	0.02
Physical sciences	0.03	0.02
Mathematics or computer sciences	0.08	0.06
Life sciences	0.04	0.06
Health sciences/health services	0.02	0.11
Humanities	0.04	0.07
Arts/applied arts	0.04	0.06
Social sciences	0.13	0.15
Applied social sciences	0.09	0.12
Other	0.02	0.01
Postgraduate education (reference = bachelor's only)		
Postbachelor's coursework	0.07	0.11
Incomplete graduate degree	0.05	0.03
Master's degree	0.08	0.10
First-professional degree	0.04	0.02
Ph.D.	0	0
Year received bachelor's degree	86.91	86.62

Table 1—Means for variables used in the regression models, by sex—Continued

	Male	Female
Background characteristics		
Family income (in thousands)	37.22	37.42
High school academic orientation scale score	0.02	0.01
High school type (reference = public)		
Attended Catholic high school	0.12	0.13
Attended private high school	0.06	0.07
High school urbanicity (reference = suburban)		
High school located in urban/central city area	0.13	0.17
High school located in rural/non-SMSA area	0.29	0.29
Total high school enrollment	1,244	1,263
Number of extracurricular activities served as leader	1.15	1.25
Race/ethnicity (reference = white, non-Hispanic)		
Black, non-Hispanic	0.05	0.06
Hispanic	0.03	0.03
Asian/Pacific Islander	0.02	0.03
American Indian/Alaskan Native	0.01	0
Black, non-Hispanic, attended high school in South	0.03	0.03
Labor market characteristics		
Number of months employed since bachelor's	49.52	53.47
Number of months employed at 1991 job	32.15	30.35
Number of months employed in 1991	11.66	11.42
Total number of months unemployed since bachelor's	1.06	1.55
Married as of December 1990	0.38	0.44
Occupation (reference = schoolteacher)		
Clerical	0.02	0.07
Laborers	0.03	0.01
Operatives and craftsmen	0.03	0
Public safety/defense	0.05	0.01
Mid-level business support	0.04	0.07
Financial service professionals	0.11	0.11
Buy/sell occupations	0.15	0.08
Professional practice (legal/medical professionals)	0.04	0.02
Licensed medical/health	0.02	0.11
Other educator/human services worker	0.03	0.06
Health/recreation services support	0.01	0.02
Computer-related occupations	0.09	0.06
Science/technical	0.15	0.05
Knowledge workers, not elsewhere classified (NEC)	0.03	0.03
Communications occupations	0.02	0.03
Arts-based occupations	0.02	0.03
Managers	0.06	0.03
Supervisor/administrator	0.08	0.07
Other occupation, not elsewhere classified (NEC)	0.01	0

Table 1—Means for variables used in the regression models, by sex—Continued

	Male	Female
Industry (reference = manufacturing)		
Agriculture or mining	0.03	0.01
Construction	0.05	0
Public utilities	0.07	0.04
Wholesale trade	0.03	0.01
Retail trade	0.08	0.08
Finance	0.15	0.15
Business services	0.06	0.05
Personal services	0.07	0.08
Recreation services	0.02	0.02
Professional services	0.15	0.35
Public administration	0.12	0.09
Engineering major in engineering occupation	0.12	0.01
Health science major in health occupation	0.01	0.09
Imputations		
Imputed FTE/faculty ratio	0.06	0.05
Imputed ratio of applicants to acceptances	0.16	0.18
Imputed per capita expenditure on instruction	0.02	0.02
Imputed log total FTE enrollment	0.02	0.01
Imputed family income	0.11	0.12
Unweighted number of cases	1,128	1,232

*Cooperative Institutional Research Project measure based on revisions by the Office of Education Research and Improvement (OERI).

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Institutional Characteristics

One purpose of this report is to identify characteristics of colleges that added value to the earnings capacity of their graduates. The variables included as part of X_2 represented institutional characteristics that may contribute to "college quality" as defined in this report. Among these characteristics were measures of institutional selectivity, size, faculty contact, governance, and expenditures.

Selectivity

In a recent series of papers, Winston (1996, 1997; Winston and Yen 1995) and his colleagues have argued that institutional selectivity is a key component of college quality. Schools

that are able to restrict enrollment increase the proportion of better-qualified, more able students. This is crucial because

> . . . to a significant degree, students educate students and the quality of the education that any one receives from his college depends in good measure on the quality of his or her fellow students. Inputs of faculty and facilities matter, too, of course, but fellow student quality counts for a very great deal in the quality of educational services the institution delivers (1996, 8).

The selectivity measure Winston identifies is the ratio of applicants to admissions, and this measure is, he notes, " . . . one of the most significant, and sought-after facts about a college's educational quality" (1996, 14). Consequently, the ratio of applications to acceptances was included among the institutional characteristics.[6]

Besides the ratio of applications to admissions, institutional selectivity may be represented by the average test scores of entering freshmen. Test scores are a proxy for the quality of a student's peers. Astin (1971) developed a measure of college selectivity using standardized test scores.[7] The Astin measure is reproduced each year as part of the Cooperative Institutional Research Project's (CIRP) annual study of college freshmen. The PETS includes a five-category version of this measure. A three-category version of the PETS variable was used to capture this aspect of institutional selectivity.[8]

Student/Faculty Ratio

The amount of contact between students and faculty may increase the quantity and quality of knowledge students obtain from their courses. Small classes have greater potential than large ones to help faculty members learn more about their students, and smaller classes may provide students with greater insights into course materials and aid in understanding them. Compared with faculty who teach at institutions with larger classes, faculty at institutions with smaller classes may have more opportunity to mentor undergraduates. Similarly, institutions with lower

[6]The selectivity of the institution a student attends may be determined in part by characteristics of the student that have not been accounted for in the model but affect earnings. Brewer, Eide, and Ehrenberg (1999), for example, explicitly modeled students' choice of college type based on a classification of institutional selectivity and public or private control, and incorporated this selection effect into their income models. Their approach thus adjusted for the possibility of omitted variables in students' choice of college type and earnings outcomes. They found no statistically significant effects of this selection effect on earnings and concluded "although we find little evidence that this correction for selectivity significantly affects our results, it is important in principle" (119).

[7]Astin (1971) developed an algorithm for converting ACT scores into SAT scores. Clifford Adelman of OERI created the PETS selectivity measure. Adelman modified the selectivity ratings from the 1987 Cooperative Institutional Research Project.

[8]The overwhelming majority of cases in the analysis sample fell into the first three categories of the PETS selectivity variable: "highly selective," "selective," and "nonselective." The two remaining categories were "open door," and "not applicable/unknown."

student/faculty ratios may create a climate where formal and nonformal activities that sustain and enrich the value of undergraduate education are more frequent.[9]

To allow for the demands on faculty time associated with part-time students as well as full-time students, the ratio of full-time-equivalent (FTE) students per faculty member was used in the regression models.[10]

Total Full-Time Equivalent Enrollment

Enrollment may be related to college quality in several different ways. First, larger schools may offer a curriculum that is broader and deeper than that offered in smaller schools. Second, a larger enrollment may promote a more diverse and stimulating student body that may improve student learning. Third, larger institutions may be in a better position to make economical use of specialized or expensive resources such as a wind tunnel or a cyclotron.

On the other hand, a broader curriculum may also encourage "milling around" and a lack of curricular focus.[11] Furthermore, large enrollment may discourage the development of student-faculty relationships that foster student achievement. Total FTE enrollment is used as the measure of size to test these competing claims about its effects.

Graduate Student Enrollment

Graduate student enrollment may indicate potential sources of undergraduate instruction, or a focus on graduate education that erodes support for undergraduate teaching among senior faculty. In order to capture this aspect of student body composition, the percentage of total institutional enrollment attributable to graduate students was included in the set of institutional characteristics.

Institutional Control

Private colleges and universities may be more efficient in their use of fiscal and other resources than are publicly controlled institutions. Private institutions may also be able to raise more money for student and faculty support from alumni since they may be more likely than

[9]These formal and informal benefits of student/faculty interaction are a central component of academic integration in Tinto's (1993) model of student dropout behavior (see especially pp. 115–116).

[10]This measure does not account for differences across institutions in the allocation of faculty time and attention to undergraduate versus graduate students. The measure is the ratio of all faculty to all students. However, the model includes the proportion of students who are graduate students as an additional control variable, which should mitigate the effect of the misspecification. Total FTE enrollment was calculated as the number of full-time students plus one-third the number of part-time students.

[11]See Grubb (1989) for a description of "milling around" in the postsecondary vocational curriculum.

public institutions to employ a staff of full-time fundraisers. A dummy variable for private control was used in the earnings equations to capture any specific advantages or disadvantages students obtain from attending a private institution.

Institutional Mission

Four-year institutions differ in the emphasis they place on the relative importance of research and teaching. Research universities, which are the major source of Ph.D.s awarded in the United States, may de-emphasize undergraduate teaching.[12] On the other hand, research universities may attract stellar faculty and graduate students who are engaged in undergraduate instruction and whose research offers exposure to the most current advances in disciplinary knowledge.

To capture differences in institutional mission, indicator variables for the Carnegie Classifications for Research University I, Research University II, and Liberal Arts College I, were used.[13] Liberal Arts College I institutions were of particular interest, since they offer highly selective undergraduate programs.

Since some research universities also have strong and highly selective undergraduate programs (e.g., Harvard and other Ivy League schools), interaction effects for private control and Research University I and private control and Research University II were included in the estimation equations.

Institutional Expenditures

Two components of institutional expenditures were included in the earnings models. The first was per FTE expenditure on instruction, and the second was per FTE expenditure on student services.[14] Spending on instruction seems to be the clearest component of institutional resources dedicated to improving the skills and knowledge of students, while student services appears in

[12]For example, a recent Carnegie Foundation for the Advancement of Teaching report on undergraduate education in research universities found that "research universities have too often failed, and continue to fail, their undergraduate populations. Tuition income from undergraduates is one of the major sources of university income, helping to support research programs and graduate education, but the students paying the tuition get, in all too many cases, less than their money's worth" (Boyer Commission 1998: 5).

[13]See the Glossary, appendix C, for a definition of each category. The reference category for each dummy variable was all other institutions.

[14]IPEDS defines student services as all expenditures for activities "whose primary purpose is to contribute to students' emotional and physical well-being and to their intellectual, cultural, and social development outside the context of the formal instructional program."

some research to affect students' decisions about which college to attend.[15] Both measures were scaled to reflect expenditures in thousands of dollars per FTE.

Other Variables

An indicator for whether an institution was an historically black college or university (HBCU) and an indicator for institutions located in the Mid-Atlantic or New England regions were also included in the set of institutional characteristics.

Estimating the Joint Contribution of Institutional Characteristics

In this report, college quality is characterized by a set of characteristics. This is in contrast to much of the literature in this area that typically uses only selectivity (see table 1 in Brewer, Eide, and Ehrenberg [1996]). Although selectivity is certainly an important dimension of the learning environment at an institution of higher education, it is arguably not value added by the institution itself. Not all institutions can choose to be selective. Other measures of the resources allocated to instructional purposes, including expenditures per student, student/faculty ratio, size of institution, the emphasis on research, and resources directed to providing graduate education, are more indicative of educational policy choices made by the institution.

Since the focus of this report is not on the contribution of any particular institutional characteristic on future earnings (although individual coefficients are sometimes discussed), the emphasis is placed on assessing the results for the institutional characteristics as a group. Although it would be valuable to produce accurate estimates of the association between each institutional characteristic and the future earnings of graduates net of the effects of other institutional characteristics, the data are not sufficient to do so. Institutions with high expenditures per student, for example, often have low student/faculty ratios. Institutions that emphasize research also emphasize graduate education and tend to be large. From a statistical perspective, this multicollinearity (or correlations among the independent variables in a regression model) increases the standard error of individual estimated coefficients. As a result, it is more difficult to conclude that a particular estimated coefficient is different from zero. Multicollinearity, however, does not affect the statistical significance of the characteristics taken as a group. The incremental R^2 or the increase in the proportion of variance in annual earnings accounted for by a group of characteristics is reported for each group in tables 2 and 3 in the "Results" section below. The statistical significance of this estimated increment is based on an F-test of the hypothesis that all the institutional

[15]Weiler (1996, 34) found that among high-ability students, "nonmonetary institutional characteristics are highly significant determinants of institutional choice."

characteristics have a zero coefficient (or, more generally, that all variables in a group have zero coefficients).[16]

Higher Education Experiences

The choices students made about their education and the experiences they had in school are represented by the X_3 variables. Besides choice of major, the effort students expended on their studies (without which ability per se is meaningless), the difficulty of the courses they took, and the amount of postgraduate education they attained were all factors that affected the stock of human capital they brought to the workplace. The variables in this set are described below.

Grade Point Average (GPA)

The association between GPA and earnings may be accounted for by several competing explanations. On the one hand, GPA may indicate the mastery of subject matter, while on the other hand, it may serve as a signal to employers about unmeasured attributes, such as cognitive ability, commitment, ability to plan, ability to set priorities among competing tasks, and so on. GPA may also not be independent of the institutional practices of the particular colleges students attended, and it may be a misleading indicator for students who took challenging and difficult courses.

One of the strengths of the combined HS&B and PETS data used in this study is that it includes information on GPA based on college transcripts along with detailed personal and pre-collegiate academic data included in the HS&B Base Year and Follow-up surveys. Thus, while Jones (1990) reported large associations between GPA and earnings on graduates' first job and the job held five years after graduation, she did not have data on students' pre-collegiate academic experiences or ability.

Credits in Calculus and Calculus-Based Courses

Credits in calculus courses were used as a proxy for the difficulty of the courses taken by undergraduates. James et al. (1989) found that the number of collegiate mathematics credits was positively associated with earnings even after controlling for personal, institutional, and labor market characteristics. Grogger and Eide (1995, 292) found a large return to mathematics ability for women, for whom a one standard deviation increase in mathematics ability was worth 7.5 percent of wages. Besides the inherent challenge of the material, the content of calculus and

[16]See Kmenta (1971, 366–367) for additional information on testing the significance of a set of independent variables.

calculus-based courses may encourage a particular kind of systematic thinking that employers find useful.

Course-Taking Diversity

The course-taking pattern of vocational education students in postsecondary institutions has been characterized as "milling around" (Grubb 1989). Without a clear focus and a coherent pattern of coursework, vocational students were ill prepared to meet the expectations of employers. A parallel study of collegiate curricular patterns in particular disciplines is just beginning, based on detailed information about courses, grades, and attainment contained in the HS&B and PETS data (Adelman 1997). Unfortunately, there is no measure that assesses the coherence of curricular choices for all the major fields of study represented in the PETS. Nevertheless, a simple count of the number of content areas in which students took courses may be a useful proxy for postsecondary "milling around." One working hypothesis is that the narrower the range of courses, the deeper the mastery of materials in a particular discipline, and consequently, the greater the returns for students with more focused studies.[17]

Major Field of Study

One of the most important decisions students made was choosing a major field of study. Grogger and Eide (1995), for example, found substantial differences in the economic returns to different college majors. They concluded that a shift away from "low-skill" majors such as education and toward "high-skill" majors such as engineering accounted for about one-fourth of the rise in the wage premium of male graduates (301).[18] Some majors are closely tied to entry into occupations for which there is a substantial labor market demand (e.g., business, engineering, and computer science). Other majors are associated with occupations for which there is less demand (e.g., art history) or for which no strong occupational mapping exists (e.g., social sciences

[17]There are, of course, easily identifiable problems with such a simple measure. Two institutions may differ in the amount of curricular "breadth" they require in a major, while the core curriculum in the major field of study is equally strong. Similarly, exposure to different kinds of knowledge is one of the virtues of a higher education, and there may be ways in which a broader education is more valuable in particular occupations. Lastly, even if knowledge in a major field of study is deeper and is accurately reflected by a lower score on the diversity measure, reward in the marketplace may depend on obtaining a job related to the field of study. Even with these problems, the course-taking measure seems a promising first step, and it is included as one of the student experience variables in the regression models.

[18]Grogger and Eide also estimated models treating choice of major as endogenous. They report the results were "largely uninformative," and the coefficients for corrections factors for omitted variables were all statistically insignificant (294).

and humanities). Since major field of study was a categorical variable, a series of 11 dummy variables were used in the estimation equations.[19]

Postgraduate Education

About one-quarter of the sample had some postgraduate education (see table 1). Those with advanced degrees, in particular, may have higher earnings due to the greater stock of human capital associated with advanced studies. A set of dummy variables representing different levels of attainment was included in the models to capture the effects of postgraduate education.

Timing of Attendance and Attainment

Students can determine when they begin their college studies, and how quickly they proceed toward degree completion. Studies of postsecondary completion have shown that students who entered 4-year institutions in the same year they graduated from high school were more likely to attain a bachelor's degree than those who entered later (Berkner, Cuccaro-Alamin, and McCormick 1996). Other studies have demonstrated a link between timing and attainment and earnings. Light (1995), for example, found that students who delayed entry into postsecondary education received lower wage increases than students who did not delay. Monks (1997) found that students who received their degrees later received significantly lower earnings' increases than students who completed their studies earlier.

One possible explanation is that students who begin their postsecondary studies immediately after high school may be more highly motivated and better prepared academically than those who do not begin at that time. Because highly motivated students may be more efficient in their studies, and may spend more time and expend more effort on academic pursuits, they may be more likely to accrue useful skills and knowledge than less motivated students.

Similarly, all other things equal, students whose time to degree was less than their peers may have unmeasured characteristics such as focus, motivation, and so on that were beneficial for on-the-job performance. To capture these effects, the year students earned their bachelor's degree was included in the earnings model. The bachelor's degree award date serves as a proxy for unmeasured motivational factors and work habits that were likely to influence job performance, and, in a more mundane way, that could affect the amount of work experience after earning the bachelor's degree.

[19]The reference category for major field of study was business. The coefficients for the dummy variables representing the other 11 majors show the difference in average annual earnings for students with each major compared with students who majored in business.

Higher Education Experience or Institutional Characteristic?

A student's decision to pursue postgraduate studies may have been influenced by many of the same factors that motivated her to attend college, or the decision may have reflected underlying differences in ability. Analogously, institutional characteristics may affect both earnings and the likelihood of students continuing their education beyond the bachelor's degree.

Similar concerns could be raised about other components included in the higher education experiences variable set. Choice of major appears to be a clear-cut student decision, but institutions may affect this decision by choosing which majors to offer. In addition, course-taking diversity may be a partial artifact of institutional decisions about course requirements. Other students (who are enrolled in large part as the result of institutional decisions about who is admitted) may influence an individual's choice of major. If the variables in X_3 were really institutional effects and not student decisions, including them in the models underestimates the importance of institutional characteristics in affecting earnings.

To address this problem, the models were estimated with and without the X_3 variables. If the coefficients for the institutional characteristics measures (X_2) remain the same, there is greater confidence that student choices of, for example, major field of study and which institution to attend do not substantially affect the estimated relationship of college characteristics on earnings.

Family Background and Pre-College Achievement

Family background affects the decision to attend college. Students whose parents attended college are more likely to attend college themselves than students whose parents did not attend (Berkner and Chavez 1997). Similarly, children from high socioeconomic status (SES) families and from families with higher incomes are more likely to attend 4-year than 2-year institutions (Eagle et al. 1988; Berkner and Chavez 1997). Access and choice, in other words, are affected by family background.

College choice is also affected by students' cognitive ability and by their academic record in high school. Students who have high ability, sufficient parental resources, and good grades are more likely to apply to and be accepted by highly selective colleges (Karabel and Astin 1975). Student attributes that lead to good grades in high school may be the same factors that account for success in the labor market. Controlling for prior achievement, ability, and family background is necessary in order to assess whether differences in earnings were due to the postsecondary institutions students attended, or if earnings differences were the consequence of variations in family background and pre-collegiate achievement.

The variables in X_1 included family income.[20] Race–ethnicity was entered into the models as a set of dummy variables,[21] and several variables in X_1 measured pre-collegiate achievement. Three measures of academic and cognitive skills (high school GPA, the HS&B cognitive test score, and average SAT score) were combined into an "academic orientation" index.[22]

School control (represented by dummy variables for attending a Catholic or other private school compared with a public school); school location (urban or rural); and school size were included in the models to control for differences in resources available for students' pre-collegiate academic experiences.

Counting the number of activities in which students held leadership positions captured their participation in extracurricular activities. This measure may serve as a signal to future employers about an individual's ability to work with others for a common purpose, which is valuable in a work setting. Alternatively, having a leadership position in high school may bode well for assuming leadership on the job. Students who take on leadership positions may be more capable of defining common goals, and they may have strong communication and organizational skills that are valuable in a work setting.

Labor Market Characteristics

Did the characteristics of the postsecondary institutions that 1980 high school sophomores attended affect earnings independently, apart from the effects of institutions on the kinds of jobs graduates held in 1991? Once individual work histories and occupation were taken into account, did the college a student attended still matter? To address these questions, detailed labor market history and occupation data were included in the models.

The dependent variable, annual earnings in 1991, is affected both by the individual's earning power per unit of time, say an hour, and by work intensity, say total hours worked in 1991. The individual's skill and experience determine earning power. Total labor market experience and specific labor market experience are included to capture the effect of experience. Hours worked in 1991 were not available on the dataset. Instead, a measure for the number of months of employment during 1991 was used to capture work intensity. Total labor market experience was defined as the number of months graduates had been employed at all jobs since graduation. Specific labor market experience was defined as the number of months graduates had worked for

[20]Socioeconomic status, the number of high school mathematics credits, and the type of high school curriculum (academic, vocational, or general) were included in preliminary analyses, but these variables had no independent effects in any model.

[21]White, non-Hispanic was the reference category for race–ethnicity.

[22]The reliability coefficient (alpha) was .74 for males and .76 for females.

their 1991 employer. Lastly, the total number of months of unemployment since graduation was included in the models to capture any lasting effects of employment instability on earnings power.

Employees differ in their commitment to work versus other responsibilities. In samples of working males, it is common to find that those who are married earn more on average than those who are single. It is also common to find the opposite result for females. In the past, career-oriented women may have found it more difficult to invest in their careers were they to marry because social norms pressured them into taking a disproportionate share of the responsibility for caring for children and maintaining the home and limited their flexibility in taking better jobs in new locations. Martial status was used as a rough proxy for unmeasured characteristics that affected choices about the amount to invest in job, employer, and career.

Two of the most important factors affecting earnings are occupation and industry. Occupation was categorized into 20 major groups, with "schoolteacher" serving as the reference category. Coefficients for the 19 occupational groups represented the difference between mean earnings for each group and mean earnings for teachers.

Industry for the job held in 1991 was grouped into 14 categories, 13 of which were entered as dummy variables. The reference category for the industry coefficients was manufacturing.

The SUDAAN software package was used to estimate the weighted least squares (WLS) regression coefficients in each model. SUDAAN incorporates information about the complex sampling design used in HS&B and calculates correct standard errors for the WLS coefficients using a Taylor series approximation.[23]

[23]See Shah, Barnwell, and Bieler (1996) for more information about SUDAAN.

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Results

Table 2 shows the coefficients for the regression of log 1991 annual earnings for men. Results for women are shown in table 3. The models in each table present the effects of college characteristics (X_2) and higher education experiences (X_3), controlling for family background and pre-collegiate academic experiences (X_1) and post-collegiate labor market characteristics (X_4). The models differ from each other in the combination of the variable sets (X_1, X_2, X_3, and X_4). The total proportion of variance in annual earnings accounted for by the variables in each model (R^2) is shown, along with the incremental change in R^2 associated with each set of variables. For both males and females, the most complete model (4) accounts for just under half the variance in earnings (47 percent).

Institutional Effects

What is the overall effect of attending a particular college on earnings given a graduate's work history? Model 1 is a "gross output" model (Conaty et al. 1989) that includes only institutional characteristics and labor market characteristics.[24] Institutional characteristics variables accounted for about 5 percent of the variance in earnings for males, and 7 percent for females. All told, model 1 accounted for 21 percent of the variance in male earnings and 30 percent in female earnings. The results for model 1 suggest that where students went to college mattered.[25]

Model 1 did not include controls for the effects of student background, pre-existing abilities, and pre-collegiate academic experiences, all of which may affect earnings.[26] These factors were included in model 2, along with institutional and labor market characteristics. The total explained variance increased for men and women alike. College characteristics in model 2,

[24]Occupation and industry are excluded in this version.

[25]One rough measure of importance is the ratio of explained variance attributable to institutional characteristics to total explained variance. Using this measure, institutional characteristics accounted for about one-quarter of explained variance in male and female earnings.

[26]In an earlier analysis (not shown here), the relative importance of family and pre-collegiate background factors were contrasted to the effects of institutional characteristics shown in model 1 (i.e., these background characteristics were included in a model that included labor market characteristics). Overall, the combination of background characteristics and labor market characteristics accounted for 22 percent of the variance in male earnings, and 27 percent in female earnings. The incremental change in earnings variance associated with background and pre-collegiate academic experiences was 6 percent for men and 4 percent for women.

Table 2—Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for male 1980 high school sophomores who earned a bachelor's degree[1]

Model	(1)	(2)	(3)	(4)
Model R^2	.206 *	.245 *	.369 *	.470 *
Incremental R^2				
Institutional characteristics[a]	.049 *	.028 *	.020 *	.020 *
Higher education experiences[a]			.123 *	.043 *
Background characteristics[a]		.039 *	.034 *	.031 *
Intercept	8.7411 *	8.7639 *	17.8317 *	16.5320 *
CIRP selectivity (reference = "nonselective")[2]				
CIRP highly selective	0.1454	0.0821	0.0689	0.0862
CIRP selective	0.1893 *	0.1561 *	0.1254 *	0.1098 *
FTE/faculty ratio	0.0056	0.0076	0.0069	0.0083 *
Ratio of applicants to acceptances	-0.0219	-0.0299	-0.0309	-0.0286
Natural log total FTE enrollment	0.0347	0.0189	0.0027	-0.0155
Percent of total FTE who were graduate students	-0.0015	-0.0011	-0.0009	0.0001
Control of school is private, not-for-profit	0.0901	0.0589	0.0226	0.0293
School located in Mid-Atlantic/New England	-0.0218	-0.0056	-0.0192	0.0165
Carnegie Classification				
Carnegie class research university I	0.0463	0.0229	-0.0083	-0.0195
Carnegie class research university II	0.0311	0.0196	0.0069	0.0063
Carnegie class liberal arts college I	0.0734	0.0394	0.1088	0.0955
Private, not-for-profit research university I	-0.1923	-0.1963	-0.2142	-0.2859 *
Private, not-for-profit research university II	-0.0207	-0.0961	-0.0384	-0.1039
Per capita (FTE) expenditure on instruction ($1000s)	0.0085	0.0111	0.0188 *	0.0192 *
Per capita (FTE) expenditure on student service ($1000s)	0.0502	0.0354	0.0159	0.0039
Historically black college or university	-0.1626	0.0723	0.0922	0.1217
Higher education experiences				
GPA (on 4-point scale)	(‡)	(‡)	0.0409	0.0194
Credits in calculus/calculus-based courses	(‡)	(‡)	0.0089	0.0067
Course-taking diversity	(‡)	(‡)	-0.0182 *	-0.0153 *
Number of community college credits	(‡)	(‡)	-0.0011	-0.0007
Major field of study (reference = business)				
Education or library sciences	(‡)	(‡)	-0.2216 *	-0.0196
Engineering, architecture, or engineering technology	(‡)	(‡)	0.1160 *	0.0175
Physical sciences	(‡)	(‡)	-0.0321	0.0068
Mathematics or computer sciences	(‡)	(‡)	0.0679	0.0387
Life sciences	(‡)	(‡)	-0.3139 *	-0.2558 *
Health sciences/health services	(‡)	(‡)	0.2462 *	0.2130 *
Humanities	(‡)	(‡)	-0.5188 *	-0.3817 *
Arts/applied arts	(‡)	(‡)	-0.3177 *	-0.0799
Social sciences	(‡)	(‡)	-0.0967	-0.0008
Applied social sciences	(‡)	(‡)	-0.1558 *	-0.0869
Other	(‡)	(‡)	-0.1485	0.0113

Table 2—Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for male 1980 high school sophomores who earned a bachelor's degree[1]—Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.206 *	.245 *	.369 *	.470 *
Incremental R^2				
Institutional characteristics[a]	.049 *	.028 *	.020 *	.020 *
Higher education experiences[a]			.123 *	.043 *
Background characteristics[a]		.039 *	.034 *	.031 *
Postgraduate education (reference = bachelor's only)				
Postbachelor's coursework	(‡)	(‡)	-0.0768	-0.0422
Incomplete graduate degree	(‡)	(‡)	-0.1091	-0.0904
Master's degree	(‡)	(‡)	0.0070	0.0198
First-professional degree	(‡)	(‡)	0.0435	-0.0217
Ph.D.	(‡)	(‡)	-0.3329	-0.2089
Year received bachelor's degree	(‡)	(‡)	-0.0986 *	-0.0843 *
Family income (in thousands)	(‡)	0.0014	0.0015 *	0.0013 *
High school academic orientation scale score	(‡)	0.0629 *	-0.0028	0.0062
High school type (reference = public)				
Attended Catholic high school	(‡)	0.0828	0.0821 *	0.0571
Attended private high school	(‡)	0.0658	0.0835	0.0935
High school urbanicity (reference = suburban)				
High school located in urban/central city area	(‡)	0.0100	0.0567	0.0907 *
High school located in rural/non-SMSA area	(‡)	0.0401	0.0366	0.0533
Total high school enrollment	(‡)	0.0000	0.0000	0.0000
Number of high school extracurricular activities served as leader	(‡)	0.0432 *	0.0511 *	0.0483 *
Race/ethnicity (reference = white, non-Hispanic)				
Black, non-Hispanic	(‡)	0.0349	-0.0471	0.0023
Hispanic	(‡)	-0.0024	0.0073	0.0441
Asian/Pacific Islander	(‡)	0.1177	0.0675	0.0812
American Indian/Alaskan Native	(‡)	-0.0242	0.1001	0.1442
Black, non-Hispanic, attended high school in South	(‡)	-0.2560	-0.3106 *	-0.3256 *
Number of months employed since bachelor's	0.0046 *	0.0042 *	-0.0020	-0.0014
Number of months employed at 1991 job	0.0031 *	0.0033 *	0.0023 *	0.0025 *
Number of months employed in 1991	0.0577 *	0.0532 *	0.0697 *	0.0669 *
Total number of months unemployed since bachelor's	-0.0224 *	-0.0225 *	-0.0258 *	-0.0220 *
Married as of December 1990	0.0610	0.0506	0.0356	0.0198
Occupation (reference = schoolteacher)				
Clerical	(‡)	(‡)	(‡)	-0.2518
Laborers	(‡)	(‡)	(‡)	-0.0461
Operatives and craftsmen	(‡)	(‡)	(‡)	-0.0964
Public safety/defense	(‡)	(‡)	(‡)	0.2372 *
Mid-level business support	(‡)	(‡)	(‡)	-0.0509
Financial service professionals	(‡)	(‡)	(‡)	0.3367 *
Buy/sell occupations	(‡)	(‡)	(‡)	0.3464 *
Professional practice (legal/medical professionals)	(‡)	(‡)	(‡)	0.3022
Licensed medical/health	(‡)	(‡)	(‡)	0.2636

Table 2—Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for male 1980 high school sophomores who earned a bachelor's degree[1]—Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.206 *	.245 *	.369 *	.470 *
Incremental R^2				
Institutional characteristics[a]	.049 *	.028 *	.020 *	.020 *
Higher education experiences[a]			.123 *	.043 *
Background characteristics[a]		.039 *	.034 *	.031 *
Other educator/human services worker	(‡)	(‡)	(‡)	-0.0461
Health/recreation services support	(‡)	(‡)	(‡)	0.1855
Computer-related occupations	(‡)	(‡)	(‡)	0.3285 *
Science/technical	(‡)	(‡)	(‡)	0.1647
Knowledge workers, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	0.3550 *
Communications occupations	(‡)	(‡)	(‡)	0.2747
Arts-based occupations	(‡)	(‡)	(‡)	-0.0003
Managers	(‡)	(‡)	(‡)	0.3841 *
Supervisor/administrator	(‡)	(‡)	(‡)	0.2362 *
Other occupation, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	-0.0416
Industry (reference = manufacturing)				
Agriculture or mining	(‡)	(‡)	(‡)	0.1673
Construction	(‡)	(‡)	(‡)	-0.1070
Public utilities	(‡)	(‡)	(‡)	-0.0719
Wholesale trade	(‡)	(‡)	(‡)	0.0571
Retail trade	(‡)	(‡)	(‡)	-0.1945 *
Finance	(‡)	(‡)	(‡)	-0.0685
Business services	(‡)	(‡)	(‡)	-0.0903
Personal services	(‡)	(‡)	(‡)	-0.1174
Recreation services	(‡)	(‡)	(‡)	-0.3426 *
Professional services	(‡)	(‡)	(‡)	-0.0739
Public administration	(‡)	(‡)	(‡)	0.0036
Engineering major in engineering occupation	(‡)	(‡)	(‡)	0.2343 *
Health science major in health occupation	(‡)	(‡)	(‡)	0.0241

[a]Statistical significance of model and incremental R^2 based on the F-test for the joint hypothesis that each variable in the combined model or the group of variables has a zero coefficient. The incremental R^2 is the change associated with including a particular group of variables compared with a model without that group.

[1]All equations estimated using a sample of 1,128 male 1980 sophomores who earned a bachelor's degree by 1990, who were not enrolled in graduate school in 1991, and who had positive earnings in 1991.

[2]Cooperative Institutional Research Project measure based on revisions by the Office of Education Research and Improvement (OERI).

*Significant at $p < .05$.

‡Variable not included in estimate.

NOTE: Other variables included in the models include dummy variables to indicate that the values of variables are missing and have been imputed for FTE (full-time-equivalent students) per faculty member, applications to acceptances ratio, FTE expenditure on instruction, total FTE, and family income. See table 1 for the proportion of cases imputed. The coefficients in this table (times 100) are the approximate percentage change in annual earnings in 1991 of a one-unit change in the variable, while the other variables remain unchanged. For example, the coefficient for months employed worked since receiving the bachelor's degree in model 1 shows that while the other variables in the model remained unchanged, each additional month worked was associated with a .46 percent increase in annual earnings. The coefficients for dummy variables show the percentage difference in annual earnings for those with a particular characteristic compared with the mean annual earnings for the reference category. For example, the coefficient for education or library science majors in model 3 shows that while other variables remained unchanged, education or library science majors earned about 22 percent less than the business majors.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Table 3—Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for female 1980 high school sophomores who earned a bachelor's degree[1]

Model	(1)	(2)	(3)	(4)
Model R^2	.297 *	.322 *	.379 *	.467 *
Incremental R^2				
Institutional characteristics[a]	.074 *	.055 *	.054 *	.041 *
Higher education experiences[a]			.057 *	.030 *
Background characteristics[a]		.025 *	.022 *	.017 *
Intercept	7.0316 *	7.2255 *	11.9448 *	11.5458 *
Institutional characteristics				
CIRP selectivity (reference = "nonselective")[2]				
CIRP highly selective	-0.0502	-0.0695	-0.0463	-0.0692
CIRP selective	-0.0768	-0.0995	-0.0500	-0.0656
FTE/faculty ratio	0.0021	0.0033	0.0015	0.0019
Ratio of applicants to acceptances	0.1215 *	0.1137 *	0.1165 *	0.1151 *
Natural log total FTE enrollment	0.1083 *	0.0877 *	0.1028 *	0.0721 *
Percent of total FTE who were graduate students	0.0035	0.0024	0.0035	0.0057
Control of school is private, not-for-profit	0.1130	0.1010	0.1020	0.0579
School located in Mid-Atlantic/New England	0.1739 *	0.1747 *	0.1641 *	0.1423 *
Carnegie classification				
Carnegie class research university I	-0.0057	0.0080	0.0103	0.0077
Carnegie class research university II	0.0386	0.0527	0.0618	0.0601
Carnegie class liberal arts college I	0.2594 *	0.2812 *	0.3230 *	0.2424 *
Private, not-for-profit research university I	-0.1188	-0.0803	-0.0373	0.0196
Private, not-for-profit research university II	0.0140	-0.0243	0.0094	-0.0284
Per capita (FTE) expenditure on instruction ($1000s)	0.0001	-0.0002	-0.0102	-0.0099
Per capita (FTE) expenditure on student services ($1000s)	0.0330	-0.0000	0.0204	0.0280
Historically black college or university	0.0420	0.0367	-0.0163	-0.0061
Higher education experiences				
GPA (on 4-point scale)	(‡)	(‡)	0.0083	0.0052
Credits in calculus/calculus-based courses	(‡)	(‡)	-0.0136	-0.0114
Course-taking diversity	(‡)	(‡)	-0.0048	-0.0043
Number of community college credits	(‡)	(‡)	-0.0009	-0.0014
Major field of study (reference = business)				
Education or library sciences	(‡)	(‡)	-0.1645 *	0.0495
Engineering, architecture, or engineering technology	(‡)	(‡)	0.1619	-0.0558
Physical sciences	(‡)	(‡)	0.0723	0.0574
Mathematics or computer sciences	(‡)	(‡)	0.1625 *	0.1678 *
Life sciences	(‡)	(‡)	-0.0876	0.0130
Health sciences/health services	(‡)	(‡)	0.1866 *	0.2809 *
Humanities	(‡)	(‡)	-0.2713 *	-0.1542 *
Arts/applied arts	(‡)	(‡)	-0.1828	0.1090
Social sciences	(‡)	(‡)	-0.1500 *	-0.0643
Applied social sciences	(‡)	(‡)	-0.1504 *	-0.0610
Other	(‡)	(‡)	-0.1638	-0.1024

Table 3—Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for female 1980 high school sophomores who earned a bachelor's degree[1] —Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.297 *	.322 *	.379 *	.467 *
Incremental R^2				
Institutional characteristics[a]	.074 *	.055 *	.054 *	.041 *
Higher education experiences[a]			.057 *	.030 *
Background characteristics[a]		.025 *	.022 *	.017 *
Postgraduate education (reference = bachelor's only)				
Postbachelor's coursework	(‡)	(‡)	-0.1801 *	-0.0916
Incomplete graduate degree	(‡)	(‡)	-0.0261	0.0056
Master's degree	(‡)	(‡)	0.0715	0.0724
First-professional degree	(‡)	(‡)	0.1505	-0.6794 *
Ph.D.	(‡)	(‡)	-0.7843 *	-0.6390 *
Year received bachelor's degree	(‡)	(‡)	-0.0524	-0.0451
Family income (in thousands)	(‡)	-0.0007	-0.0009	-0.0015
High school academic orientation scale score	(‡)	0.0454	-0.0011	-0.0062
High school type (reference = public)				
Attended Catholic high school	(‡)	0.1160 *	0.0974	0.0750
Attended private high school	(‡)	0.0673	0.0938	0.0912
High school urbanicity (reference = suburban)				
High school located in urban/central city area	(‡)	-0.0694	-0.0966	-0.0304
High school located in rural/non-SMSA area	(‡)	-0.0798	-0.0923 *	-0.0670
Total high school enrollment	(‡)	0.0000	0.0001 *	0.0000
Number of high school extracurricular activities served as leader	(‡)	0.0128	0.0172	0.0150
Race/ethnicity (reference = white, non-Hispanic)				
Black, non-Hispanic	(‡)	0.0230	0.0137	-0.0011
Hispanic	(‡)	0.1802 *	0.1644 *	0.1614 *
Asian/Pacific Islander	(‡)	0.1188	0.0467	0.0517
American Indian/Alaskan Native	(‡)	0.9212 *	0.9001 *	0.7684
Black, non-Hispanic, attended high school in South	(‡)	0.0299	0.0172	0.0275
Number of months employed since bachelor's	0.0048 *	0.0043 *	0.0013	0.0014
Number of months employed at 1991 job	0.0038 *	0.0037 *	0.0032 *	0.0033 *
Number of months employed in 1991	0.1130 *	0.1127 *	0.1162 *	0.1064 *
Total number of months unemployed since bachelor's	-0.0123 *	-0.0111	-0.0108	-0.0095
Married as of December 1990	-0.0568	-0.0488	-0.0561	-0.0855 *
Occupation (reference = schoolteacher)				
Clerical	(‡)	(‡)	(‡)	-0.1842
Laborers	(‡)	(‡)	(‡)	-0.4035 *
Operatives and craftsmen	(‡)	(‡)	(‡)	-0.5507 *
Public safety/defense	(‡)	(‡)	(‡)	0.2617 *
Mid-level business support	(‡)	(‡)	(‡)	0.0253
Financial service professionals	(‡)	(‡)	(‡)	0.3086 *
Buy/sell occupations	(‡)	(‡)	(‡)	0.3411 *
Professional practice (legal/medical professionals)	(‡)	(‡)	(‡)	1.1419 *
Licensed medical/health	(‡)	(‡)	(‡)	0.3519 *

Table 3—Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for female 1980 high school sophomores who earned a bachelor's degree[1] —Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.297 *	.322 *	.379 *	.467 *
Incremental R^2				
Institutional characteristics[a]	.074 *	.055 *	.054 *	.041 *
Higher education experiences[a]			.057 *	.030 *
Background characteristics[a]		.025 *	.022 *	.017 *
Other educator/human services worker	(‡)	(‡)	(‡)	0.1118
Health/recreation services support	(‡)	(‡)	(‡)	0.0567
Computer-related occupations	(‡)	(‡)	(‡)	0.3107 *
Science/technical	(‡)	(‡)	(‡)	0.1223
Knowledge workers, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	0.1916
Communications occupations				0.0938
Arts-based occupations	(‡)	(‡)	(‡)	-0.1733
Managers	(‡)	(‡)	(‡)	0.3282 *
Supervisor/administrator	(‡)	(‡)	(‡)	0.2727 *
Other occupation, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	0.3532 *
Industry (reference = manufacturing)				
Agriculture or mining	(‡)	(‡)	(‡)	-0.0695
Construction	(‡)	(‡)	(‡)	0.0275
Public utilities	(‡)	(‡)	(‡)	0.0569
Wholesale trade	(‡)	(‡)	(‡)	-0.1157
Retail trade	(‡)	(‡)	(‡)	-0.0959
Finance	(‡)	(‡)	(‡)	-0.0411
Business services	(‡)	(‡)	(‡)	0.1258
Personal services	(‡)	(‡)	(‡)	-0.1419
Recreation services	(‡)	(‡)	(‡)	-0.0831
Professional services	(‡)	(‡)	(‡)	-0.0941
Public administration	(‡)	(‡)	(‡)	-0.1348
Engineering major in engineering occupation	(‡)	(‡)	(‡)	0.2964
Health science major in health occupation	(‡)	(‡)	(‡)	-0.1871

[a]Statistical significance of model and incremental R^2 based on the F-test for the joint hypothesis that each variable in the combined model or the group of variables has a zero coefficient. The incremental R^2 is the change associated with including a particular group of variables compared with a model without that group.

[1]All equations estimated using a sample of 1,232 female 1980 sophomores who earned a bachelor's degree by 1990, who were not enrolled in graduate school in 1991, and who had positive earnings in 1991.

[2]Cooperative Institutional Research Project measure based on revisions by the Office of Education Research and Improvement (OERI).

*Significant at $p < .05$.

‡Variable not included in estimate.

NOTE: Other variables included in the models include dummy variables to indicate that the values of variables are missing and have been imputed for FTE (full-time-equivalent students) per faculty member, applications to acceptances ratio, FTE expenditure on instruction, total FTE, and family income. See table 1 for the proportion of cases imputed. The coefficients in this table (times 100) are the approximate percentage change in annual earnings in 1991 of a one-unit change in the variable, while the other variables remain unchanged. For example, the coefficient for months employed since the bachelor's degree in model 1 shows that while the other variables in the model remained unchanged, each additional month worked was associated with a .48 percent increase in annual earnings. The coefficients for dummy variables show the percentage difference in annual earnings for those with a particular characteristic compared with the mean annual earnings for the reference category. For example, the coefficient for education or library science majors in model 3 shows that while other variables remained unchanged, education or library science majors earned about 16 percent less than the business majors.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

however, accounted for less of the variance in male earnings than they did in model 1, but the contribution remained statistically significant (3 percent versus 5 percent).[27] Model 2 showed a similar reduction in the proportion of earnings variance accounted for by college characteristics for females as that in model 1 (6 percent versus 7 percent), but this amount remained statistically significant.

Model 3 introduced the set of higher education experience variables. With these included, college characteristics accounted for 2 percent of the variance in earnings for males. For females, however, college characteristics accounted for about the same proportion of earnings variance as they did in model 2 (5 percent versus 6 percent).

The addition of occupation and industry in model 4, the most complete of the earnings equations, shows that college characteristics continued to account for 2 percent of the variance in male earnings. However, they accounted for 4 percent of the variance in female earnings.[28]

To summarize, college characteristics accounted for a relatively small proportion of the overall variance in male earnings and a larger, but still relatively small, proportion of total variance in female earnings. Nonetheless, the contribution of college characteristics to future earnings was statistically significant in all four models for both males and females. In addition, college characteristics appear to account for more of the variance in female earnings than do higher education experiences.

Estimating the Effect of the Set of Institutional Characteristics on Earnings

Although institutional characteristics accounted for a relatively small part of the total variability in earnings, their cumulative effect may be substantial. For example, although they accounted for only 2 percent of the total variance in earnings for males (once the effects of family background, pre-collegiate academic experiences, and higher education experiences were taken into account), attending a college with moderately better characteristics might increase a man's earnings by 8.1 percent four years after graduation. Over the course of an average working life, this could amount to $100,000 more income. For females, the likely effects were even larger.

[27]Normally a comparative statement about effect sizes, either within a group or between groups, would be subjected to a statistical test (e.g., a *t* test for the difference in group means). There is no simple way of comparing changes in incremental R^2. from one model to the next within each group or across groups. Consequently, there are no references to the statistical significance of comparative differences noted in the text. Whenever comparative statements are made about a set of characteristics accounting for more or less variance in one model compared with another, or a set of characteristics being more or less important for men compared with women, such comparisons are based only on the size of the incremental R^2. Readers should be especially cautious about these comparisons.

[28]Using the simple ratio described in footnote 25, college characteristics accounted for 4 percent of the total explained variance in earnings for males, and 9 percent for females in model 4.

The effect of a one standard deviation change in a variable in a multiple regression model can be determined directly from its estimated coefficient and its standard deviation. Estimating the effect of a similar change in a group of variables is somewhat more involved. First, a composite institutional characteristics variable was constructed by summing the product of each institutional characteristic and its coefficient. The value of this composite variable was the same for two males who graduated from the same college but differed for male and female students who graduated from the same college. Although the values of the institutional characteristics were the same for male and female students attending the same college, the estimated coefficients were different.

The differences in the composite quality variable across institutions can be interpreted directly as the predicted difference in earnings of students four years after graduation. The standard deviation of the composite variable is the difference in earnings between, for example, a graduate from an institution with a composite value one standard deviation above the mean to a graduate from an institution with a composite value at the mean.

Males who attended colleges for which the composite institutional characteristic variable was one standard deviation above the average had predicted earnings $2,311 above the average of $28,567, or an 8.1 percent increase.[29] For females, the comparable increment was $3,746 above the average of $21,590, or a 17.4 percent increase.[30] These effects are comparable to the estimated effect of attending an additional year of college.[31]

To extend these "short-term" estimates on earnings four or five years after graduation to "long-term" estimates on earnings over a working life required two additional steps. First, this

[29]Although it is customary to directly interpret differences in the natural log of variables as percentage differences, a slightly more accurate method was used here. The predicted earnings associated with a particular bundle of college characteristics (in natural log units) was added to the mean predicted earnings associated with all variables other than college characteristics separately for males and females. Next, this sum was exponentiated to translate the predicted effect into dollars. Finally, the percentage difference between two different bundles of characteristics was calculated.

[30]In addition to contrasting the difference in predicted earnings associated with a set of institutional characteristics one standard deviation above the mean to predicted earnings associated with institutional characteristics at the mean, the difference between predicted earnings associated with institutional characteristics one standard deviation above and one standard deviation below the mean was also calculated. These differences were almost twice as large as those for the one used in the text. In addition, the differences between predicted earnings for a bundle of institutional characteristics associated with attending the 100th college to those associated with attending the 400th college were also calculated. (Students in the sample attended over 500 colleges.) The differences for this contrast were almost 40 percent larger still. In summary, the contrast made in the text is a modest one that realistically is available to many students making their college choice.

[31]Readers should approach these comparisons with caution, both because the estimation ignores a number of possible complexities and because there is no way to conduct a statistical test of the differences reported. Data available in *The Condition of Education 1998* (supplemental tables 32-1 and 32-3) were used in this calculation. The difference in 1991 median annual earnings for all wage and salary workers with a bachelor's degree versus median earnings for high school graduates was calculated separately for males and females. These differences were divided by four to estimate the effect of each additional year of college, and converted to 1991 dollars. For men, the estimated benefit of a year of college was $2,662, close to the estimated premium of attending an institution with characteristics one standard deviation above the mean ($2,311). For females, the estimated effect of an additional year of college was $2,766, while the estimated institutional characteristics premium was $3,746.

effect was translated into a stream of annual increments to earnings over a working life. Second, the present value of the stream of increments was calculated.[32]

The first step, calculating the stream of earnings increments, required knowledge of how the predicted effect, which in this study was measured only the fourth or fifth year after graduation, would evolve over the person's working life. The working life for these calculations was assumed to be 40 years. The calculation also requires an assumption about the character of the earnings premium. Does the effect of attending a college with a good bundle of characteristics fade after some number of years, or does the effect compound, that is, grow larger? The HS&B data do not provide evidence one way or the other on this question. It was assumed for the purpose of this calculation that the earnings increment grows at a moderate rate—7 percent per year.[33] That is, not only does a graduate from a college with good characteristics earn more than his or her counterpart who graduated from a college with average characteristics, but also that advantage grows over time. This is plausible if graduates from better colleges get the better jobs, and the better jobs, in turn, offer better training and advancement opportunities that lead to better wages.

The second and final step was to calculate the present value at the time a prospective freshman must make his or her decision as to which college to attend. The assumption is that a student's decision will be influenced by knowledge of the future stream of higher income that might result from attending a college with better characteristics. The calculation accounts for the fact that people prefer a dollar today to a dollar tomorrow, which is the reason banks have to pay interest to induce people to save money. A 5 percent discount rate results in a lifetime earnings premium with a present value of $107,153 evaluated at the beginning of the freshman year for males, and $173,678 for females.[34]

This summary requires additional qualification. There is a possibility that some portion of the variance accounted for by the higher education experience variables, as well as the occupation and industry variables, were the result of college characteristics. One of the ways in which college characteristics can affect earnings is to limit curricular choice to majors that are more or less highly rewarded in the labor market. More selective colleges may provide greater opportunities for undergraduates to establish social networks, both among themselves and with alumni,

[32]See appendix A, pp. 59–60, for a detailed description of the present value calculation.

[33]This is assuming a growth rate of 5 percent would reduce the figure for men from $107,000 to $72,000, and a 3 percent growth rate would reduce the figure to $52,000.

[34]A discount rate of 7 percent reduces the figure for men from $107,000 to $65,000, and a discount rate of 3 percent would increase the figure for men to $184,000. The discount rate is often estimated by economists to be equal to the "real rate of interest," that is, the interest rate minus the inflation rate on a security with little or no risk. Three percent is a plausible figure for a discount rate; the 5 percent figure used as a basis for the figures cited in the text is conservative.

that are important for providing contacts and information about more lucrative jobs. In addition, selective institutions may encourage undergraduate cultures that value hard work and effort and create rewards for participation in academic as opposed to social activities.

By including outcomes such as major in the set of higher education experiences and not as an effect of college quality, the models may underestimate the relative importance of college characteristics for later earnings. Comparing the R^2 in model 2 with model 3 provides a boundary on the possible effects of college characteristics. For males, college characteristics accounted for 2 to 3 percent of the variance in earnings. For females, college characteristics accounted for about 6 percent of the variance in both models, confirming the independence of the institutional characteristics' contribution to female earnings.

Which Specific Characteristics of Colleges Influenced Earnings?

The answer to this question is addressed separately for men and women. Furthermore, the estimated effects reported below should always be interpreted as net of or after taking account of the effects of other college characteristics on earnings. Institutional selectivity was an important characteristic for men. Attending a "selective" college or university compared with a "nonselective" college (as measured by the CIRP ratings) added between 11 and 19 percent to yearly earnings for males after taking account of expenditures per pupil, academic mission, size, and so on.

Per capita expenditures on instruction also had a positive, though very small, association with earnings. Increasing per capita instructional expenditures by $1,000 was associated with increases in male earnings of about 2 percent. There was no significant effect of instructional expenditures on earnings for women.

Academic mission (teaching versus research) and private control were associated with male earnings when all variables were included in the model (model 4). Men who attended large research-oriented institutions (Research I) that were privately controlled had earnings that were less than those of students who attended other types of institutions. These effects were large (29 percent in model 4) and inexplicable. Participation in postgraduate studies seemed to be a possible explanation at first. A larger proportion of graduates from private Research I Universities enrolled in some type of postgraduate education compared with graduates of other types of colleges and universities (40 percent versus 25 percent).[35] As table 4 shows, students who enrolled in most types of post-baccalaureate education worked fewer months at their 1991 job compared with students with no post-baccalaureate education.[36] But both post-baccalaureate education and

[35]The difference is statistically significant for all comparisons.

work experience are included in the regression models. The negative association between attending a private Research University I and earnings, therefore, has to be associated with some other factor or factors not included in the models.

Table 4—Average number of months 1980 sophomores were employed at all jobs since college graduation, and the average number of months worked at 1991 job, by postsecondary attainment

	Postsecondary attainment				
	Bachelor's	Post-graduate coursework	Incomplete graduate degree	Master's	First-professional
Months employed since bachelor's	52.2	52.1	49.5	52.3	37.2
Months employed at 1991 job	33.0	26.3	25.1	28.7	19.6

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Attendance at an historically black college or university (HBCU) was included among the institutional characteristics. The evidence that attendance at such institutions results in better outcomes for black students than attendance at non-HBCU institutions is mixed (Ehrenberg and Rothstein 1994). Students attending HBCU institutions come from families with lower incomes than black, non-Hispanic students who attend non-HBCU schools.[37] On the other hand, HBCU schools may have institutional cultures and policies that encourage students to persist and complete their degrees (Allen, Epps, and Haniff 1991). The data in tables 2 and 3 suggest that net of other variables included in the models, there were no short-term effects of attending an HBCU on earnings.[38] These results correspond with those of Ehrenberg and Rothstein (111–113), who reported no increase in hourly earnings for black students attending an HBCU based on data from NLS–72.[39]

With respect to early career earnings, therefore, black students who attended an historically black college or university appeared neither to gain nor to lose from their decision.

[36]The minimum *t* for comparisons of months of work experience at the 1991 job for those with and without post-baccalaureate education was 2.82, except for the difference between those with a bachelor's only and those with a master's degree.

[37]According to the 1989–90 National Postsecondary Student Aid Survey (NPSAS:90), 53 percent of black, non-Hispanic students attending HBCUs came from families in the lowest income quartile compared with 38 percent of black, non-Hispanic students not attending an HBCU. Nine percent of HBCU students came from families in the top income quartile compared with 17 percent of black, non-Hispanic students attending a non-HBCU school.

[38]Several additional tests of the effect of attending an historically black college or university yielded similar findings. Dummy variables for the interactions of being black with attending or not attending an HBCU were included in model 2. None of the coefficients for men or women were statistically significant.

[39]Constantine (1995), on the other hand, found an earnings premium of 8 to 38 percent associated with attending an HBCU. Her analysis was also based on NLS–72, but measured earnings later in students' careers and controlled for the decision to attend an HBCU.

The effects of college characteristics on female earnings remained relatively constant across the different specifications (these effects are net of all other factors included in the models). As mentioned previously, using the proportion of earnings variance accounted for by institutional characteristics in models 2 and 3, college characteristics were associated with about 5 to 6 percent of the variance in female earnings. Institutional characteristics accounted for about twice as much variance in earnings for women as did the combined effects of family background and precollegiate academic experiences (6 percent versus 3 percent and 5 percent versus 2 percent in models 2 and 3, respectively). The constancy in R^2 associated with institutional characteristics in models 2 and 3 (which differ only in the presence of higher education experiences in model 3) suggests that institutional characteristics may have played an independent role in affecting female earnings.

The results presented in table 3 suggest that women benefited from attending selective institutions, measured by the ratio of applications to acceptances. A one-unit increase in this ratio was associated with an 11 to 12 percent increase in earnings.

Women who attended a school located in the Mid-Atlantic or New England regions increased their earnings from 14 to 17 percent. Women who attended colleges that are highly selective, predominantly private institutions ("Liberal Arts College I" in the Carnegie Classification) earned anywhere from 24 to 32 percent more than women who attended other kinds of schools. Even when two of the major ways that institutions may contribute to student earnings (sorting into selected majors and occupations) were controlled for in model 4, women who attended a selective liberal arts college had earnings 24 percent higher than they would have had had they attended a different kind of school.

On the other hand, attending a larger institution was also beneficial to women: a 1 percent increase in total enrollment was associated with a 7 to 11 percent increase in their earnings. Apparently, it is not the small size of selective liberal arts colleges that benefits women but some other characteristic of these colleges.

There were some factors that students and their families think about when deciding where to matriculate that did not independently affect female earnings. Institutional expenditures on instruction and student services and the student to faculty ratio were among this group. The relatively high correlation among some of the institutional characteristics may account for some of this.[40]

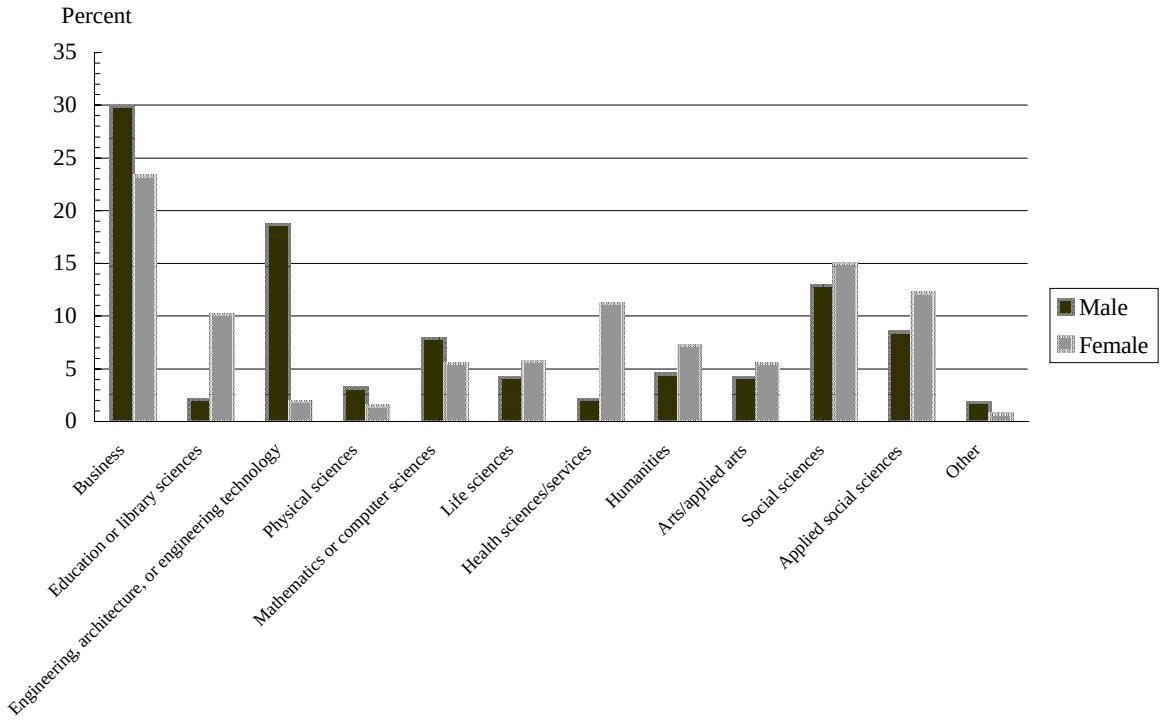
[40]The institutional-level correlation between instructional spending and the applications/acceptances ratio, for example, was .58 in the sample of colleges women attended; the correlation between spending on student services and the applications/acceptances ratio was .44.

Higher Education Experiences

Major Field of Study

Overall, student decisions about major field of study, course-taking diversity, and time to degree appear to have accounted for a larger proportion of the variance in male earnings than female earnings. Choice of major was important for both groups. Figure 1 illustrates the percentage of men and women who majored in different fields.

Figure 1—Percentage distribution of major field of study for 1980 high school sophomores who earned a bachelor's degree, by sex



SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

There were large differences in the majors students chose by sex. Women were more likely than men to major in education and library science (10 percent versus 2 percent), and much less

likely to major in engineering, architecture, and engineering technology (2 percent versus 19 percent).[41]

Major field of study is included in models 3 and 4 of tables 2 and 3. We begin with a consideration of the effects in model 3.[42] (The reference category in these comparisons was business, so the coefficients for major in tables 2 and 3 represent the difference between the mean earnings of business majors and the mean earnings for each of the other fields.)

There were only a few majors more lucrative for men than business, notably health sciences: students with this major earned about 25 percent more than business majors, and engineering, architecture, and engineering technology majors earned about 12 percent more. Men who majored in education or library science earned 22 percent less than male students who majored in business. Other less remunerative majors for men included the humanities, arts, applied social sciences, and life sciences.[43] Assuming equal qualifications, male graduates with these majors earned 16 to 52 percent less than they would have had they chosen to major in business.

Some majors had earnings returns similar to business. Men who majored in mathematics/computer science or physical science, for example, did about as well as men with business majors (neither coefficient was significantly different from zero).

With one or two exceptions, the association between major and earnings for women was similar to that for men. Women who majored in health sciences earned about 19 percent more than women who majored in business. Unlike males, however, there was no earnings advantage associated with a major in engineering (although the coefficient was positive, it was not statistically significant). Also, in contrast to men, women who majored in mathematics or computer science earned about 16 percent more than women who majored in business.

The major fields of study with lower earnings were similar to those for men: the humanities, social sciences, and applied social sciences. The coefficient for life sciences was negative, as it was for men, but not statistically significant.

Overall, there was a reasonably clear association between field of study and earnings for both men and women. Business, health sciences, and generally most technical fields (such as engineering, architecture, mathematics or computer science, and the physical sciences) had better earnings returns than did the arts, humanities, and social sciences.

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[41]The differences reported here for choice of major by sex are similar to those found by Rumberger and Thomas (1993, 3–5), analyzing a sample drawn from the 1987 Recent College Graduates (RCG) Survey.

[42]Although the choice of major is discussed as if it were exogenous, as noted earlier, family background, ability, and other factors may well have affected it.

[43]The coefficient for social sciences was somewhat statistically significant at $.05<p<.10$.

One way a field of study may have affected earnings was through the student's choice of occupation. Entering occupations into the regression models[44] (model 4) should, if this account is correct, decrease the magnitude of the coefficients for major field of study. The evidence from model 4 in tables 2 and 3 partially supports this hypothesis. The coefficient for male education majors in table 2, model 3 (without the occupation and industry dummy variables included) was -.22. After adding the occupation and industry variables in model 4, the coefficient for education majors was not significantly different from zero. This finding suggests that the negative return to an education major shown in model 3 was a consequence of education majors working in low-paid jobs as teachers. As shown in table 5, schoolteachers' earnings were among the lowest of all occupational groups.[45] Similarly, the coefficient for students with engineering, architecture, or engineering technology majors in model 3 was .12, but not significantly different from zero in model 4.

Table 5—Mean earnings by occupation for 1980 sophomores who earned a bachelor's degree, by sex: 1991

	Male	Female
Total	$31,730	$25,068
Clerical	—	15,522
Laborers	25,948	—
Operatives and craftsmen	—	—
Public safety/defense	31,845	—
Mid-level business support	22,163	21,074
Financial service professionals	35,917	30,167
Buy/sell occupations	33,609	29,141
Professional practice (legal/medical professionals)	33,400	33,272
Licensed medical/health	—	29,448
Schoolteachers	21,716	19,139
Other education/human services worker	21,274	20,705
Health/recreation services support	—	—
Computer-related occupations	34,321	32,238
Scientific/technical	35,687	24,834
Knowledge workers, NEC (not elsewhere classified)	32,841	—
Communications occupations	—	20,407
Arts-based occupations	—	21,930
Managers	38,003	30,063
Supervisors/administrators	30,569	27,863
Other occupation, NEC	—	—

—Too few cases for reliable estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

[44]"Schoolteacher" was the reference category for occupation.

[45]Male teachers' earnings were not significantly different from those of males employed as clerical workers, other education and service workers, mid-level business support, and knowledge workers not elsewhere classified. For all other occupations shown in table 5, teachers' earnings were significantly lower. Female teachers' earnings were not significantly different from those of females employed in clerical, mid-level business support, other education and services, communications, arts, and scientific/technical occupations. Female teachers' earnings were lower for the remaining occupations shown in table 5.

Other Factors

There was an earnings penalty for men associated with "milling around" in the postsecondary curriculum. The measure of course-taking diversity used in the regression models was a simple count of the number of major curriculum areas used to classify courses in the PETS transcript files (Adelman 1995). There was a 2 percent decrease in earnings for each additional curricular area represented on a male student's transcript (see model 3). Among women, course-taking diversity had no effect on earnings.

Remember that the diversity measure was crude, and it was subject to a number of confounding factors such as institutional definitions of required "curricular breadth" requirements for undergraduates, choice of major, and so on. Model 3 did include major field of study, so systematic differences in breadth requirements for different majors were partially controlled. It may be that "milling around" in the postsecondary academic curriculum reflects underlying personality factors that also affect on-the-job performance, for example, a lack of focus or an inability to make clear decisions. "Milling around" may also reflect lesser amounts of human capital, because knowledge obtained in college was scattered over many areas, without any one area being acquired in depth.

Alternatively, the negative coefficient may reflect employers' decisions. Highly diverse transcripts may serve as a signal to employers that potential employees' skills and knowledge are less concentrated or too diffuse.

Some portion of the negative returns may also reflect changes in the structure of the economy. While general knowledge of many areas, as reflected in a liberal arts major, may have once been valued by employers, movement in the economy away from manufacturing toward more technical areas may have shifted the advantage toward graduates with more technical and focused disciplines. Or, the effect may be temporary and confounded by the relatively early time in the labor market for this sample of college graduates. It is reasonable, for example, to believe that general education may gain in value as the scope of an employee's responsibilities increase.

Whichever of these explanations accounted for the negative earnings for men, why was a similar effect not found for women? Overall, women had greater course-taking diversity than did men (see table 1), and overall, their earnings were less, too (by almost $7,000, see table 5). The lack of an additional effect of course-taking diversity on women's earnings may reflect differences in the labor market for women. If discrimination accounted for women being paid less than men, any earnings penalty associated with course-taking diversity may have been subsumed in the discriminatory wage. There is, however, no way to conclude with the data available whether

this or some other explanation better accounts for the difference between men and women in the effect of course-taking diversity on earnings.

One result shown in tables 2 and 3 was the lack of returns for education beyond the bachelor's degree. (Postgraduate returns were measured as differences between the mean return for bachelor's degree recipients and those who attained more than a bachelor's degree.) In fact, the only statistically significant coefficient occurred for women (for attaining a Ph.D.), and it was negative. According to human capital theory, additional education beyond the bachelor's degree level should augment earnings. Yet none of the coefficients was statistically significant for men, and the only significant coefficients for women were negative (for post-baccalaureate coursework and earning a doctorate in model 3, and first-professional and doctoral degrees in model 4).

There are some possible explanations for this result. One explanation may lie with the timing of the data collection. Bachelor's degree recipients who participated in postgraduate studies traded employer-specific work experience for future potential earnings (see table 4). It may be too early to detect higher earnings for those with postgraduate education. With a longer time horizon, however, positive returns might have been found. Resolving this issue requires data that measure returns to education over a longer period of time. Earlier work using NLS–72 showed that men and women who earned first-professional and doctoral degrees had significantly higher earnings than those of bachelor's degree recipients. The earnings comparisons were examined when sample members had seven to nine years of work experience (Conaty et al. 1989).

Men who took longer to complete their degrees, either because they delayed entry or simply took longer due to intermittent or less than full-time enrollment, were at an earnings disadvantage (table 2). Delaying graduation a year reduced earnings between 8 and 10 percent. This was net of any effects delayed attainment may have had on work experience, since the models included both the number of months of work experience since receipt of the bachelor's degree and the number of months employed in the 1991 job. This effect was not significant for women.

The year a person received his or her bachelor's degree is negatively correlated (-.70) with the number of months of employment experience since the bachelor's in this sample. As a result, the data are not well suited for distinguishing the effect of later graduation, which may be due to a variety of factors including the student's motivation, from the effect of less work experience. Adding the year the bachelor's degree was awarded to models 3 and 4 eliminated the effect of general labor market experience observed in models 1 and 2.

Finally, there was no apparent disadvantage for men or women who earned credits at a community college. Although the sign of the coefficients for the number of community college credits was negative for both men and women, none were statistically significant.

Background and Labor Market Characteristics

Tables 2 and 3 include detailed information about family background and pre-collegiate academic achievement that predated college choice and college experiences, and labor market characteristics that occurred after college. The pre-collegiate variables were introduced to serve as proxies for ability and human capital formed by the family or purchased for students. The labor market characteristics took into account factors that played an important role in determining earnings, and their inclusion in the models permitted an assessment of college quality contributions net of easing students into more lucrative and stable occupations.

Family Background and Pre-Collegiate Academic Achievement

Controlling for family background adjusts the estimates of college effects for the role played by parental education, income, and student academic achievement net of their effects on deciding to attend a 4-year college or university. Since the sample consisted of only those 1980 high school sophomores who attained a bachelor's degree or higher, the amount of variability in family and academic achievement may have been much less than if the entire HS&B Sophomore Cohort had been included. Yet even with this sample restriction, family background was associated with graduates' 1991 earnings.[46] For men, the net contribution of family background on earnings was slightly larger than the effects of college characteristics (see models 2, 3, and 4). The introduction of family background and pre-collegiate academic experience variables in model 2 reduced the incremental R^2 for institutional characteristics shown in model 1, suggesting that some of the unadjusted effects of institutional characteristics on earnings in model 1 were due to differences in pre-existing student characteristics.

Family background characteristics accounted for somewhat less earnings variance after higher education experiences were included in model 3 for both men and women. However, the proportion of earnings variance was still statistically significant (about 2 percent for women and 3 percent for men) even after occupation and industry were included in model 4.

Over all, family background characteristics and pre-collegiate academic experiences accounted for a little more of the variance than college characteristics in men's earnings. On the other hand, college characteristics accounted for a bit more variance than background characteristics in women's earnings.

There were several effects of family background characteristics and pre-collegiate academic experiences on 1991 earnings. First, a unit increase in men's high school academic orientation

[46]This finding differs from that of Rumberger and Thomas (1993), who analyzed the 1987 RCG Survey. They did not have as rich a source of information about students' high schools and families, however.

scale score (based on high school GPA, cognitive test scores, and SAT score) was associated with a 6 percent increase in earnings after controlling for college characteristics (see model 2). After adding major field of study and other higher education experience variables in model 3, the coefficient for pre-collegiate academic orientation became nonsignificant. This suggests that pre-collegiate academic orientation may have influenced men's future earnings in part through its relationship with choice of major.

There has been a longstanding interest in the effects of Catholic high schools on student achievement (Coleman, Hoffer, and Kilgore 1982). Dummy variables for attending a Catholic high school and for attending a private, nonreligious high school were included in the models. (The reference category was attendance at a public high school.) There was some evidence that both men and women benefited from attending a Catholic high school. For men, the effect on earnings was about 8 percent, while for women, the effect was about 12 percent.[47]

One persistent finding was the earnings advantage that accrued to men (but not women) associated with being a leader in high school activities. In each of the models that included family background characteristics, men who had served as a leader of a social, academic, or sporting organization earned an additional 4 to 5 percent. Thus, even in model 4, which introduced controls for college characteristics, higher education experiences, family background, and detailed labor market experiences including occupation and industry, men who had been high school leaders earned an additional 5 percent for each leadership position held. It may be that men who assumed organizational responsibilities in high school were more motivated than their peers, and this motivation reflected underlying attitudes and skills that were useful in the labor market. Alternatively, perhaps these students were especially capable of overcoming adversity, making compromises, or organizing themselves and their co-workers. In any case, high school leadership was associated with earnings advantages later in their careers.

Race and ethnic group differences did not account for earnings differences among this group of male college graduates, with one exception. Black men who attended high school in the South experienced continuing disadvantages, even after controlling for differences in background, college major, occupation, and so on. The size of this disadvantage was substantial, ranging from about 31 to 33 percent.

Hispanic and American Indian/Alaskan Native women who graduated from a 4-year institution obtained an earnings premium. Hispanic women earned between 16 and 18 percent more

[47]The coefficients for attending a Catholic high school were significant in at least one of the models for each sex, but failed to reach conventional levels in the remaining models.

than similarly qualified white women,[48] and the premium for American Indian/Alaskan Native women appeared larger (although the coefficient in model 4 did not reach conventional levels of statistical significance). There are several possible explanations for these differences. They may reflect exceptional personal characteristics of the women from these racial–ethnic groups, who were less likely to earn a bachelor's or other higher degree than were white women. Alternatively, the earnings premium may reflect employers' appraisals of otherwise unmeasured abilities, or they may reflect higher labor market demand for college-educated minorities.[49] It remains unclear, however, why there was no similar earnings premium for black women or for men from minority groups.

General Labor Market Characteristics

Labor market factors accounted for most of the variance in 1991 earnings for men and women, and the associations between many labor market characteristics and earnings were similar for both groups. Each month of employment at the 1991 job for men, for example, was associated with about a .3 percent increase in earnings. Each month of general work experience (the total number of months worked since receiving the bachelor's degree) increased male and female earnings by about .4 percent (in model 2 only). The fact that the coefficients for general work experience decreased towards zero and were not statistically significant in models 3 and 4 may reflect a negative correlation between general work experience and the year students received their bachelor's degrees.

Unemployment appeared to have an effect on earnings beyond the simple reduction in work experience. Men lost about 2 percent in earnings for every month they were unemployed. In most models, there was no significant effect of unemployment on women's earnings.

Marriage had different effects on earnings depending on sex. Marital status was included in the models to capture unmeasured factors that influence the amount of time and effort available for labor market activity. This effect was not significant for men. For women, however, the effects of marriage on earnings were negative when controlling for all other factors. In the most complete model (4), young married women's earnings were 9 percent lower than those of their counterparts who were not married. It is not clear from these data if the negative coefficient for marriage reflects added responsibilities for childcare, women's greater responsibilities for other aspects of household management, employer discrimination, or some other alternative.

[48]Rumberger and Thomas (1993, 8) found a 7 percent earnings premium for Hispanic women compared with white and black women. There were too few Asian/Pacific Islander or American Indian/Alaskan Native women in the sample to include them in their analysis.

[49]Twenty-seven percent of white females had attained a bachelor's or higher degree by 1992 compared with 10 percent of Hispanic females and 6 percent of American Indian/Alaskan Native females.

Occupation and Industry

The linkage between major and occupation was one likely mechanism by which student factors (or alternatively, college characteristics) affected earnings. Model 4 included dummy variables for occupation and industry. The reference category for occupation was schoolteacher, and the reference category for industry was manufacturing.

The coefficients for occupation indicate that there were seven occupations that had significantly higher earnings (managers, supervisors, financial services professionals, sales, computer-related, knowledge-based, and public safety), with the earnings premium ranging from a low of 24 percent for supervisor/administrator jobs to a high of 38 percent for managers. The situation was similar for women. There were two occupations with significantly lower earnings than schoolteachers (laborers and operatives and craftsmen). Nine occupational groups had higher earnings compared with schoolteachers. As with men, managers, supervisors, financial services professionals, and sales jobs were among the most highly rewarded. Finally, women doctors and lawyers were especially well paid compared with teachers.

Conclusion

This report examined the importance of college characteristics for early career earnings. It combined detailed data about the demographic, academic, and labor market characteristics of a nationally representative sample of high school sophomores who graduated from college in the mid-1980s with information about the colleges they attended, the courses they took, and their postsecondary attainment. The key analytical issue was to determine the relative contribution of the characteristics of the colleges attended by 1980 sophomores to their earnings four to five years after graduation. How important were college characteristics in affecting earnings after controlling for pre-collegiate academic experiences and social background, differences in what students studied in college, the amount of time and effort they devoted to academic pursuits, and later labor market characteristics such as occupation and industry?

College quality was treated as a concept made up of many components. These included aspects of admissions selection; size and composition of the student body (e.g., the percentage of graduate students); institutional mission (research versus teaching); expenditures on instruction and student services; and faculty/student ratio.

A number of findings were reported. Institutional characteristics accounted for a small proportion of the variance in male earnings (from 2 to 5 percent), and a larger proportion of variance in female earnings (from 4 to 7 percent). As controls for background characteristics and students' higher education experiences were added to the models, the amount of variance attributable to college effects became smaller. Separating all aspects of higher education experiences from college characteristics (i.e., treating these experiences as determined by factors outside of this model and not determined by institutions), college characteristics accounted for 2 percent of the variance in male earnings, and 4 percent of the variance in female earnings (see model 4, tables 2 and 3).

Although college characteristics appeared to account for a relatively small proportion of the total variance in earnings for men, and somewhat more but still a relatively small proportion for women, their cumulative effect could amount to thousands of dollars in lifetime earnings. The predicted earnings associated with a bundle of institutional characteristics one standard deviation above average for a man with average earnings was estimated to be about $2,300 a year. Over the course of a working life, the estimated present value of this "quality premium" amounts to almost $107,000. Depending on assumptions about discount rates, starting salaries, and the quality

percentiles being contrasted, the present value difference could be more than $206,000. For women, the difference in predicted lifetime earnings associated with attending a college with a bundle of institutional characteristics one standard deviation above average was almost $174,000.

If the amount of variance in income explained by college characteristics per se was small, there was a large return to "higher education experiences," defined as aspects of college life for students. Furthermore, the proportion of variance in earnings accounted for by higher education experiences for men was larger than the combined effects of background and college characteristics (see model 3, table 2). Some, but not all, of this effect was due to the link between major field of study and occupation. For men, selecting a profitable major, and making prompt progress toward a degree, had a larger effect on future earnings than did the characteristics of the college they attended.

The findings for women were somewhat different. Student choice variables had about the same effect on female earnings as did institutional characteristics (6 percent versus 5 percent in model 3), while for men, explained variance for higher education experiences was about six times larger (12 percent versus 2 percent, model 3). Overall, institutional characteristics played a larger role in accounting for variance in female earnings. Depending on the particular model, college quality measures contributed from 4 to 7 percent of the variance in female earnings. Even after family background characteristics, pre-collegiate academic achievement, and student higher education experiences were added to the models, the amount of explained variance due to institutional characteristics was remarkably stable. Indeed, with occupation and industry included in model 4, college quality measures accounted for about 4 percent of the variance in earnings. Women appeared to do especially well if they attended selective liberal arts colleges located in the northeastern part of the country.

Why did college characteristics account for more of the variance in women's earnings than men's? No conclusive answer to this question can be found in these data. One possible explanation is that women face continuing discrimination in the labor market. The form this discrimination takes may involve different wages for similar work, but it may also include different assessments of ability. Employers may feel that a degree from a selective college or university is more important to certify the skills and abilities of female applicants than for male applicants. Alternatively, the experience of attending a selective postsecondary institution may not have been experienced uniformly by women and men. Women, for example, may have changed in ways that increased their skills and abilities more than men's.[50]

[50]See Kingston and Smart (1990, 156) for a similar argument based on analysis of 1971 and 1980 Cooperative Institutional Research Program (CIRP) data.

The findings for the effects of labor market characteristics on earnings indicated that some, but not all, of the effects of higher education experiences on future earnings were due to the relationship between major and occupation.

The coefficients for background characteristics suggest that early family advantages associated with income continued to affect students' earnings even after the relationship of family income to the probability of attending college, and 4-year colleges in particular, had been accounted for. Compared with the entire cohort of 1980 high school sophomores, those who graduated from a 4-year college were much more likely to be homogeneous. Consequently, the effects of background and demographic characteristics would have been attenuated. Among men, however, those from wealthier families continued to accrue additional advantages. Each thousand dollar increase in family income was associated with a .1 to .2 percent increase in 1991 earnings. Early in their careers, therefore, it appeared that the male recent college graduates included in this analysis received additional benefits associated with family income (for example, parental contacts or superior information about jobs).

What do these findings suggest for the tens of thousands of high school graduates and their families who every spring make decisions about which college to attend and how much to pay? Are these results any clearer for female students and their families? Although differences among colleges can have a large effect on lifetime earnings, choices that students make regardless of which college they attend (especially major field of study) have substantial effects on later labor market outcomes.

But there is more that goes into a decision about which college to attend than the prospect of future earnings, and as these data indicate, the answer may be different for men than for women. Institutional characteristics appear to have made more of a difference for women than they did for men. One reason for this may be the particular historical development of selective liberal arts colleges in the East and New England that provide especially strong support for women's education. Such institutions may have a climate that emphasizes women's achievements, treats women's careers seriously, or these institutions may allocate substantial resources to developing strong contacts with employers.[51]

Earnings are certainly an important outcome of a college education, and the earnings advantage of a college degree is well documented. But there are other important outcomes of higher education that were not included in this analysis. Students (and their families) differ in the value they place on these other outcomes (for example, contact with a diverse group of students and

[51]Berkner et al. (1996) develop evidence from the Beginning Postsecondary Students Study that suggests a strong association between a student's social and academic integration into college during their first year and attainment of a bachelor's degree within 5 years.

faculty, development of cultural and aesthetic interests, and so on), and these differences likely affect their willingness to incur higher costs of attendance. But regardless of the particular outcome that is most highly valued, these findings, like the earlier findings of Conaty et al. (1989), suggest that choosing a high-cost, highly selective institution in and of itself does not guarantee higher earnings, at least early in students' labor market careers. Similarly, choosing to attend a lower cost public college or university does not guarantee lower earnings.

References

Adelman, C. 1995. *The New College Course Map and Transcript Files.* Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

Adelman, C. 1997. *Leading, Concurrent, or Lagging? The Knowledge Content of Computer Science in Higher Education and the Labor Market.* Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

Allen, W.R., Epps, E.G., and Haniff, N.Z., Eds. 1991. *College in Black and White.* Albany: State University of New York Press.

Astin, A. 1971. *Predicting Academic Performance in College.* New York: Free Press.

Berkner, L., and Chavez, L. 1997. *Access to Postsecondary Education for the 1992 High School Graduates.* Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

Berkner, L.K., Cuccaro-Alamin, S., and McCormick, A.C. 1996. *Descriptive Summary of 1989–90 Beginning Postsecondary Students 5 Years Later: With an Essay on Postsecondary Persistence and Attainment.* Washington, DC: U.S. Department of Education, National Center for Educational Statistics.

Bound, J., Griliches, Z., and Hall, B.H. 1986. "Wages, Schooling, and IQ of Brothers and Sisters: Do the Family Factors Differ?" *International Economic Review* 27: 77–105.

Boyer Commission on Educating Undergraduates in the Research University, 1998. *Reinventing Undergraduate Education.* New York: Carnegie Foundation for the Advancement of Teaching.

Brewer, D.J., Eide, E., and Ehrenberg, R.G. 1996. "Does It Pay to Attend an Elite Private College? Evidence from the Senior High School Class of 1980." *Research in Labor Economics* 15: 239–271.

Brewer, D.J., Eide, E., and Ehrenberg, R.G. 1999. "Does It Pay to Attend an Elite Private College? Evidence on the Effects of College Type on Earnings." *Journal of Human Resources* 34: 104–123.

College Entrance Examination Board. 1985. *Annual Survey of Colleges, 1985–86, Summary Statistics.* New York: College Board.

Coleman, J., Hoffer, J., and Kilgore, S. 1982. *High School Achievement: Public, Catholic, and Private Schools Compared.* New York: Basic.

Conaty, J., Alsalam, N., James, E., and To, D. 1989. "College Quality and Future Earnings: Where Should You Send Your Child to College?" Paper prepared for the American Sociological Association meetings, August 1989.

Constantine, J.M. 1995. "The Effect of Attending Historically Black Colleges and Universities on Future Wages of Black Students." *Industrial and Labor Relations Review* 48: 531–546.

Daniel, K., Black, D., and Smith, J. 1995. "College Quality and the Wages of Young Men." Unpublished paper.

Dunn, O.J. 1961. "Multiple Comparisons Among Means." *Journal of the American Statistical Association* 56: 52–64.

Eagle, E., Fitzgerald, R., Gifford, A., and Tuma, J. 1988. *A Descriptive Summary of 1980 High School Sophomores: Six Years Later.* Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.

Ehrenberg, R.G., and Rothstein, D.S. 1994. "Do Historically Black Institutions of Higher Education Confer Unique Advantages on Black Students? An Initial Analysis," in *Choices and Consequences: Contemporary Policy Issues in Education.* Ed. R.G. Ehrenberg. Ithaca, NY: ILR Press.

Eide, E., Brewer, D.J., and Ehrenberg, R.G. 1998. "Does It Pay to Attend an Elite Private College? Evidence on the Effects of Undergraduate College Quality on Graduate School Attendance." *Economics of Education Review* 17: 371–376.

Fox, M. 1993. "Is it a Good Investment to Attend an Elite Private College?" *Economics of Education Review* 12: 137–151.

Frankel, M., Kohnke, L., Buonanno, D., and Tourangeau, R. 1981. *High School and Beyond Sample Design Report.* Chicago: National Opinion Research Center.

Grogger, J., and Eide, E. 1995. "Changes in College Skills and the Rise of the College Wage Premium." *Journal of Human Resources* 30: 280–310.

Grubb, W.N. 1989. "Access, Achievement, Completion, and 'Milling Around' in Postsecondary Education." Berkeley, CA: MPR Associates for the U.S. Department of Education, National Assessment of Vocational Education.

Hirshleifer, J. 1984. Price Theory and Applications, 3rd edition. Englewood Cliffs, NJ: Prentice-Hall.

Ishida, H. 1990. "Educational Credentials and the Labour Market in Japan: A Cross-National Comparison with the United States and Britain." *International Journal of Comparative Sociology* 31: 139–155.

James, E., Alsalam, N., Conaty, J., and To, D. 1989. "College Quality and Future Earnings: Where Should You Send Your Child to College?" *AEA Papers and Proceedings* 79: 247–252.

James, E., and Alsalam, N. 1993. "College Choice, Academic Achievement, and Future Earnings," in *Essays on the Economics of Education*. Ed. E.P. Hoffman. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Jones, C., and B.D. Spencer. 1985. *High School and Beyond Second Follow-up (1984) Sample Design Report.* Chicago: National Opinion Research Center.

Jones, E.B. 1990. "College Grades and Labor Market Outcomes." *Journal of Human Resources* 25: 253–266.

Karabel, J., and Astin, A. 1975. "Social Class, Ability, and College 'Quality'." *Social Forces* 53: 381–398.

Katz, L., and Murphy, K. 1992. "Changes in Relative Wages, 1963–1987: Supply and Demand Factors." *Quarterly Journal of Economics* 107: 35–78.

Kingston, P., and Smart, J. 1990. "The Economic Pay-Off of Prestigious Colleges," in *The High-Status Track*. Ed. P. Kingston and L. Lewis. Albany, NY: State University Press.

Kmenta, J. 1971. *Elements of Econometrics.* New York: Macmillan.

Levy, F., and Murnane, R. 1992. "U.S. Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations." *Journal of Economic Literature* 30: 1331–1381.

Light, A., 1995. "The Effects of Interrupted Schooling on Wages." *Journal of Human Resources* 30: 472–502.

Lillard, L.A. 1977. "Inequality: Earnings vs. Human Wealth." *American Economic Review* 67: 42–53.

Loury, L.D., and Garman, D. 1995. "College Selectivity and Earnings." *Journal of Labor Economics* 13: 289–308.

Monks, J. 1997. "The Impact of College Timing on Earnings." *Economics of Education Review* 15: 419–423.

Mueller, R. 1988. "The Impact of College Selectivity on Income for Men and Women." *Research in Higher Education* 29: 175–191.

Murnane, R.J., Willett, J.B., and Levy, F. 1995. "The Growing Importance of Cognitive Skills in Wage Determination." *The Review of Economics and Statistics* 78: 251–266.

Murphy, K., and Welch, F. 1989. "Wage Premiums for College Graduates: Recent Growth and Possible Explanations." *Educational Researcher* 18: 17–26.

National Commission on the Cost of Higher Education. 1998. *Straight Talk About College Costs and Prices*. Washington, D.C.: American Council on Education.

Rumberger, R., and Thomas, S. 1993. "The Economic Returns to College Major, Quality, and Performance: A Multilevel Analysis of Recent Graduates." *Economics of Education Review* 12: 1–19.

Shah, B.V., Barnwell, B.G., and Bieler, G.S. 1996. *SUDAAN User's Manual, Release 7.0.* Research Triangle Park, NC: Research Triangle Institute.

Spilerman S., and Lunde, T. 1991. "Features of Educational Attainment and Job Promotion Prospects." *American Journal of Sociology* 97: 689–720.

Tinto, V. 1993. *Leaving College.* 2nd edition. Chicago: University of Chicago.

Tourangeau, R., McWilliams, H., Jones, C., Frankel, M., and O'Brien, F. 1983. *High School and Beyond First Follow-up (1982) Sample Design Report.* Chicago: National Opinion Research Center.

Trusheim D., and Crouse, J. 1981. "Effects of College Prestige on Men's Occupational Status and Income." *Research in Higher Education* 14: 283–304.

U.S. Department of Education, National Center for Education Statistics. 1998. *The Condition of Education 1998.* Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Education, National Center for Education Statistics. 1997. *The Condition of Education 1997.* Washington, D.C.: U.S. Government Printing Office.

Weiler, W.C. 1996. "Factors Influencing the Matriculation Choices of High Ability Students." *Economics of Education Review* 15: 23–36.

Winston, G. 1996. "The Economic Structure of Higher Education: Subsidies, Customer-Inputs, and Hierarchy." Williams Project on the Economics of Higher Education #40. Williamstown, MA: Williams College.

Winston, G. 1997. "Why Can't a College Be More Like a Firm?" *Change* 29(5): 32–39.

Winston, G., and Yen, I.C. 1995. "Costs, Prices, Subsidies, and Aid in U.S. Higher Education." Williams Project on the Economics of Higher Education #32. Williamstown, MA: Williams College.

Zahs, D., Pedlow, S., Morrissey, M., Marnell, P., and Nichols, B. 1994. *The High School and Beyond Fourth Follow-up Methodology Report.* Section 3. Washington, DC: U.S. Department of Education, National Center for Education Statistics, Postsecondary Longitudinal Studies Branch.

Appendix A—Technical Notes and Methodology

The High School and Beyond Surveys

The High School and Beyond (HS&B) study began in the spring of 1980 with the collection of Base-Year questionnaire and test data on more than 58,000 high school seniors and sophomores. The First Follow-up Survey was conducted in the spring of 1982, the Second Follow-up in the spring of 1984, the Third Follow-up in the spring of 1986, and the Fourth Follow-up in the spring of 1992.

The HS&B Fourth Follow-up Survey is the fifth wave of the longitudinal study, but unlike previous rounds, the Fourth Follow-up focused exclusively on a sophomore class. The Fourth Follow-up included two components: a respondent survey with sample of 14,825 members of the 1980 Sophomore Cohort, and a transcript study based on the 9,064 Sophomore Cohort members who reported postsecondary attendance. The goals of the Fourth Follow-up were to obtain information on issues of access to and choice of undergraduate and graduate educational institutions, persistence in attaining educational goals and progress through the curriculum, rates of degree attainment and of other educational outcomes, and labor market outcomes in relation to educational attainment and labor market experiences.

Sample Design

In the Base Year, students were selected using a two-stage, stratified probability sample design with schools as the first-stage units and students within schools as the second-stage units.[52] The total number of schools selected for the sample was 1,122, from a frame of 24,725 schools with grades 10 or 12 or both. Within each stratum, schools were selected with probabilities proportional to the estimated enrollment in their 10th and 12th grades. Within each school, 36 seniors and 36 sophomores were randomly selected. In those schools with fewer than 36 seniors or 36 sophomores, all eligible students were drawn in the sample.

The First Follow-up Sophomore and Senior Cohort samples were based on the HS&B Base-Year samples, retaining the essential features of a stratified multi-stage design.[53]

[52]For further details on the Base-Year sample design, see Frankel et al. (1981).

[53]For further details, see Tourangeau et al. (1983).

Subsequent to the First Follow-up Survey, high school transcripts were sought for a probability subsample of nearly 18,500 members of the 1980 Sophomore Cohort. The subsampling plan for the Transcript Study emphasized retaining members of subgroups of special relevance for education policy analysis. Compared with the Base-Year and First Follow-up Surveys, the Transcript Study sample design further increased the overrepresentation of racial and ethnic minorities (especially those with above-average HS&B achievement test scores), students who attended private high schools, school dropouts, transfers and early graduates, and students whose parents participated in the Base-Year Parents' Survey on financing postsecondary education.

The samples for the Second and Third Follow-up surveys of the 1980 Sophomore Cohort were based upon the transcript study design. A total of 14,825 cases were selected from among the 18,500 retained for the transcript study. The Sophomore Cohort Second and Third Follow-up samples included disproportionate numbers of sample members from policy-relevant subpopulations (e.g., racial and ethnic minorities, students from private high schools, high school dropouts, students who planned to pursue some type of postsecondary schooling, and so on).[54] The members of the Senior Cohort selected into the Second Follow-up sample consisted exactly of those selected into the First Follow-up sample. The Third Follow-up was the last one conducted for the Senior Cohort.

The Fourth Follow-up is composed solely of members from the Sophomore Cohort. Those selected into the Fourth Follow-up sample were identical to those selected into the Second and Third Follow-up sample. For any student who ever enrolled in postsecondary education, complete transcript information was requested from the institutions indicated by the student.

Sample Weights

The general purpose of weighting is to compensate for the unequal probability of selection into the sample, and to adjust for respondent nonresponse to the survey. The weights are based on the inverse of the selection probabilities at each stage of the sample selection process and on nonresponse adjustment factors computed within weighting cells. The Fourth Follow-up had two major components: the collection of survey data and the collection of postsecondary transcript data. Nonresponse occurred during both of these data collection phases. Weights were computed to account for nonresponse during either phase. FU4WT was computed for all Fourth Follow-up respondents. For more information about the design and implementation of the survey weights, see section 3 of the *High School and Beyond Fourth Follow-up Methodology Report* (Zahs et al. 1994).

[54]See tables 2.4-1 through 2.4-4 of Jones and Spencer (1985).

The Integrated Postsecondary Education Data System

The Integrated Postsecondary Education Data System (IPEDS) is a comprehensive data repository that encompasses all identified institutions whose primary purpose is to provide postsecondary education. IPEDS consists of institutional-level data that can be used to describe trends in higher education at the institutional, state, and/or national levels.

Postsecondary education is defined within IPEDS as the provision of formal instructional programs whose curriculum is designed primarily for students who have completed the requirements for a high school diploma or its equivalent. This includes academic, vocational, and continuing professional education programs, and excludes avocational and adult basic education programs.

IPEDS includes information about baccalaureate or higher degree-granting institutions, 2-year award institutions, and less-than-2-year institutions (i.e., institutions whose awards usually result in terminal occupational awards or are creditable toward a formal 2-year or higher award). Each of these three categories is further disaggregated by control (public; private, nonprofit; and private, for-profit), resulting in nine institutional categories or sectors.

Data are collected from approximately 11,000 postsecondary institutions. IPEDS has been designed to produce national-, state-, and institutional-level data for most postsecondary institutions. However, prior to 1993, only national-level estimates from a sample of institutions were available for the private, less-than-2-year institutions.

Data in IPEDS are organized in several areas. For this report, the most important areas include the following:

Institutional Characteristics, including institutional names, addresses; congressional districts; counties; telephone numbers; tuition; control or affiliation; calendar systems; levels of degrees and awards offered; types of programs; credit and contact hour data; and accreditation for all postsecondary education institutions in the United States and outlying territories.

Fall Enrollment, including information about full- and part-time enrollment by racial/ethnic category and sex for undergraduates, first-professional, and graduate students. Age distributions by level of enrollment and sex are collected in odd-numbered years, and first-time degree-seeking student enrollments by residence status are collected in even-numbered years.

Financial Statistics, including each institution's current fund revenues by source (e.g., tuition and fees, government, gifts); current fund expenditures by function (e.g., instruction, research); assets and indebtedness; and endowment investments.

Other components of IPEDS provide data on degree completion, faculty salaries and tenure, library resources, and the characteristics of fall staff. Detailed information about IPEDS is available at the National Center for Education Statistics Web site (http://nces.ed.gov).

The College Board Annual Survey of Colleges

Each year the College Board conducts a survey of accredited two- and four-year colleges and universities. For 1985–86, the Annual Survey collected information on over 3,300 postsecondary institutions. The survey form includes questions about undergraduate enrollment, admissions, progress toward a degree, curriculum, financial aid, and institutional selectivity. For institutions that had missing data elements in IPEDS, information from the 1985–86 Annual Survey of Colleges was used.[55]

Accuracy of Estimates

The statistics in this report are estimates derived from a sample. Two broad categories of error occur in such estimates: sampling and nonsampling errors. Sampling errors occur because observations are made only on samples of students, not on entire populations. Nonsampling errors occur not only in sample surveys but also in complete censuses of entire populations.

Nonsampling errors can be attributed to a number of sources: inability to obtain complete information about all students in all institutions in the sample (some students or institutions refused to participate, or students participated but answered only certain items); ambiguous definitions; differences in interpreting questions; inability or unwillingness to give correct information; mistakes in recording or coding data; and other errors of collecting, processing, sampling, and imputing missing data.

The standard error is a measure of the variability due to sampling when estimating a parameter. It indicates how much variance there is in the population of possible estimates of a parameter for a given sample size. Standard errors can be used as a measure of the precision expected from a particular sample. The probability that a complete census would differ from the sample by less than the standard error is about 68 out of 100. The chances that the difference would be less than 1.65 times the standard error are about 90 out of 100, and that the difference would be less than 1.96 times the standard error, about 95 out of 100. Standard errors for the text tables and figures are presented in appendix B.

[55]See College Entrance Examination Board (1985) for more details about the Annual Survey and examples of the type of data available.

Estimates

Many of the estimates presented in this report were produced using the SUDAAN software package. SUDAAN makes it possible for users to specify and generate a variety of univariate and multivariate analyses from the HS&B data, including tests of means, logistic and multiple regression, and linear and loglinear modeling of contingency tables.[56] SUDAAN calculates proper standard errors and weighted sample sizes for these estimates.[57] If the number of valid cases is too small to produce an estimate, SUDAAN was instructed to suppress cell frequencies for tables and comparisons among means.

Statistical Procedures

Two types of statistical procedures were used in this report: testing differences between means and regression analyses. Each procedure is described below.

Differences Between Means

The descriptive comparisons were tested in this report using Student's *t* statistic. Differences between estimates are tested against the probability of a Type I error, or significance level. The significance levels were determined by calculating the Student's *t* values for the differences between each pair of means or proportions and comparing these with published tables of significance levels for two-tailed hypothesis testing.

Student's *t* values may be computed to test the difference between estimates with the following formula:

$$t = \frac{E_1 - E_2}{\sqrt{se_1^2 + se_2^2}}$$

where E_1 and E_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors. Note that this formula is valid only for independent estimates.

[56]For further details, see Shah, Barnwell, and Bieler (1996).

[57]The HS&B samples are not simple random samples and, therefore, simple random sample techniques for estimating sampling error cannot be applied to these data. SUDAAN takes into account the complexity of the sampling procedures and calculates standard errors appropriate for such samples. The method for computing sampling errors used by SUDAAN involves approximating the estimator by the linear terms of a Taylor series expansion. The procedure is typically referred to as the Taylor series method.

There are hazards in reporting statistical tests for each comparison. First, large *t* values may appear to merit special attention. However, the magnitude of the *t* statistic is related not only to the observed differences in means or percentages but also to the number of students in the categories that are being compared. A small difference compared across a large number of students will produce a large *t* statistic.

Second, as the number of comparisons on the same set of data increases, the likelihood that the *t* value for at least one of the comparisons will exceed 1.96 simply due to sampling error increases. For a single comparison, there is a 5 percent chance that the *t* value will exceed 1.96 due to sampling error. For five tests, the risk of getting at least one *t* value that high increases to 23 percent, and for 20 comparisons, it increases to 64 percent.

One way to compensate for this danger when making multiple comparisons is to adjust the critical value that the *t* statistic must equal or exceed to take into account the number of comparisons being made. This is done using a Bonferroni adjustment to control for the number of possible comparisons—the family of comparisons—between the categories of the variable being tested. Family size, *k,* is calculated as follows: $k = [j * (j - 1)]/2$, where *j* is equal to the number of categories in the variable. In a five-category variable such as race–ethnicity, *k* would be equal to [(5)(5-1)]/2, or 10. The family size is then used to adjust the probability that one would incorrectly conclude that two estimates were different because of sampling error.

Comparisons were made in this report only when $p \leq .05/k$ for a particular pairwise comparison, where that comparison was one of *k* tests within a family. This guarantees both that the individual comparison would have $p \leq .05$ and that for *k* comparisons within a family of possible comparisons, the significance level for all the comparisons will sum to $p \leq .05$.[58] In the case of race–ethnicity, the value of p was ≤ 0.005 (that is, 0.05/10). In order to conclude that two estimates were different in this case, the critical value that the *t* statistic had to equal or exceed was 2.81, which was obtained from a table of *t* statistics for a two-tailed test.

Regression Coefficients

The multivariate models used to assess the association among institutional characteristics, educational process variables, labor market variables, and demographic variables were based on weighted least squares (WLS) regression. Most major statistical analysis software programs assume simple random sampling when computing the standard errors of the regression coefficients.

[58]The standard that $p \leq .05/k$ for each comparison is more stringent than the criterion that the significance level of the comparisons should sum to $p \leq .05$. For tables showing the *t* statistic required to ensure that $p \leq .05/k$ for a particular family size and degrees of freedom, see Olive Jean Dunn, "Multiple Comparisons Among Means," *Journal of the American Statistical Association* 56 (1961): 52–64.

Since the HS&B sample was a clustered and stratified design, standard software programs underestimate the sampling variability of the OLS coefficients. SUDAAN, however, uses Taylor series linearization to calculate the appropriate standard errors, and it is these standard errors that were used to assess the statistical significance of the coefficients in each model.[59]

Present Value

Most people would prefer to receive a dollar today than to receive a dollar 1 year from now. Suppose a person could invest a dollar today and receive one dollar plus interest in 1 year. The discount rate (*d)* is defined as the rate of interest that leaves a person indifferent between receiving a dollar today and a dollar plus the accumulated interest in the future. For a person with discount rate *d,* the present value (*PV*) of *E* dollars received in 1 year is:

$$PV = \frac{E}{(1+d)} \tag{1}$$

PV dollars invested today at interest rate *d* would be worth *PV**(1+*d*) in 1 year. Since this is equal to *E*, the person is indifferent between receiving *PV* dollars today and *E* dollars in 1 year.

The principal of present value can be extended to a stream of payments in the future. A person with discount rate *d* is indifferent between *PV* today and a stream of payments E_1, E_2, E_3, … in 1, 2, 3 years and so forth if

$$PV = \frac{E_1}{(1+d)} + \frac{E_2}{(1+d)^2} + \ldots + \frac{E_N}{(1+d)^N} \tag{2}$$

And extending it further to a stream that starts in *T* years, the present value is:

$$PV = \frac{E_1}{(1+d)^T} + \frac{E_2}{(1+d)^{T+1}} + \ldots + \frac{E_N}{(1+d)^{T-1+N}} \tag{3}$$

For purposes of this report, think of these payments as due to the decision to attend a "better" college or university. Assume earnings are paid at the end of the year and it takes 4 years to earn a bachelor's degree. If *T*=5, the present value is estimated 5 years before receiving the first payment, i.e., at the beginning of freshman year. If *T*=1, the present value is estimated at college graduation.

Let *N* equal the number of years the person expects to work. For simplicity assume that

[59]See Shah, Barnwell, and Bieler (1996, 9-3, 9-4) for a description of how SUDAAN estimates the regression model.

$$E_1=E,\ E_2=E(1+g),\ \ldots,\ E_N=E(1+g)^{N-1} \tag{4}$$

that is, assume that the earnings increment grows by a factor $(1+g)$ each year. Substituting (4) into (3) and factoring E, we get

$$PV=\left(\frac{1}{(1+d)^T}+\frac{1+g}{(1+d)^{T+1}}+\ldots+\frac{(1+g)^{N-1}}{(1+d)^{T+N-1}}\right)E \tag{5}$$

In the special case of $d=g$, this expression simplifies to

$$PV=N\frac{E}{(1+d)^T} \tag{6}$$

Otherwise, multiplying both sides of (5) by $(1+g)/(1+d)$ leads to

$$PV\left(\frac{1+g}{1+d}\right)=\left(\frac{1+g}{(1+d)^{T+1}}+\frac{(1+g)}{(1+d)^{T+2}}+\ldots\frac{(1+g)^{N-1}}{(1+d)^{T+N-1}}+\frac{(1+g)^N}{(1+d)^{T+N}}\right)E \tag{7}$$

Notice that the first term of (7) is the same as the second term of (5), and the next-to-last term of (7) is the same as the last term of (5). Subtracting (7) from (5) results in

$$PV\left(1-\left(\frac{1+g}{1+d}\right)\right)=\left(\frac{1}{(1+d)^T}-\frac{(1+g)^N}{(1+d)^{T+N}}\right)E \tag{8}$$

because all terms cancel except the first of (5) and the last of (7).

The factor multiplying PV on the left-hand side of (8) can be simplified as follows:

$$\left(1-\left(\frac{1+g}{1+d}\right)\right)=\frac{(1+d)-(1+g)}{1+d}=\frac{d-g}{1+d} \tag{9}$$

Multiplying both sides of (8) by the reciprocal of (9),

$$PV=\frac{1}{d-g}\left(\frac{1}{(1+d)^{T-1}}-\frac{(1+g)^N}{(1+d)^{T-1+N}}\right)E \tag{10}$$

Equations (5) and (10) can be used to calculate the present value to a person with discount rate d of an earnings increment E that begins in T years and grows annually by a factor $(1+g)$.[60] Equation (10) is used to calculate the figures given in the text.

[60]See Hirshleifer (1984, 453–458) for more details.

Appendix B—Standard Error Tables

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Table B1—Standard errors for table 1: Means for variables used in the regression models, by sex

	Male	Female
Institutional characteristics		
CIRP selectivity (reference = "non-selective")*		
CIRP highly selective	0.009	0.008
CIRP selective	0.016	0.015
FTE/faculty ratio	0.197	0.191
Ratio of applicants to acceptances	0.036	0.028
Natural log total FTE enrollment	0.045	0.044
Percent of total FTE who were graduate students	0.329	0.315
Control of school is private, not-for-profit	0.019	0.017
School located in Mid-Atlantic/New England	0.021	0.020
Carnegie classification		
Carnegie class research university I	0.017	0.016
Carnegie class research university II	0.013	0.012
Carnegie class liberal arts college I	0.008	0.008
Private, not-for-profit research university I	0.008	0.006
Private, not-for-profit research university II	0.003	0.003
Per capita (FTE) expenditure on instruction	103	111
Per capita (FTE) expenditure on student services	22	15
Historically black college or university	0.004	0.006
Higher education experiences		
GPA (on 4-point scale)	0.019	0.016
Number of mathematics credits at calculus level or above	0.084	0.056
Course-taking diversity	0.121	0.119
Number of community college credits	0.859	0.852
Major field of study (reference = business)		
Education or library sciences	0.005	0.011
Engineering, architecture, or engineering technology	0.015	0.005
Physical sciences	0.007	0.006
Mathematics or computer sciences	0.012	0.008
Life sciences	0.007	0.010
Health sciences/health services	0.005	0.012
Humanities	0.008	0.010
Arts/applied arts	0.007	0.009
Social sciences	0.014	0.014
Applied social sciences	0.011	0.012
Other	0.005	0.003
Postgraduate education (reference = bachelor's only)		
Postbachelor's coursework	0.010	0.012
Incomplete graduate degree	0.009	0.006
Master's degree	0.011	0.011
First-professional degree	0.008	0.007
Ph.D.	0.002	0.002
Year received bachelor's degree	0.045	0.039

Table B1—Standard errors for table 1: Means for variables used in the regression models, by sex —Continued

	Male	Female
Background characteristics		
Family income (in thousands)	0.885	0.841
High school academic orientation scale score	0.034	0.031
High school type (reference = public)		
Attended Catholic high school	0.016	0.013
Attended private high school	0.014	0.014
High school urbanicity (reference = suburban)		
High school located in urban/central city area	0.017	0.019
High school located in rural/non-SMSA area	0.024	0.022
Total high school enrollment	39.299	36.152
Number of extracurricular activities served as leader	0.056	0.060
Race/ethnicity (reference = white, non-Hispanic)		
Black, non-Hispanic	0.008	0.008
Hispanic	0.006	0.005
Asian/Pacific Islander	0.003	0.007
American Indian/Alaskan Native	0.002	0.002
Black, non-Hispanic, attended high school in South	0.006	0.006
Labor market characteristics		
Number of months employed since bachelor's	0.59	0.52
Number of months employed at 1991 job	0.77	0.81
Number of months employed in 1991	0.06	0.07
Total number of months unemployed since bachelor's	0.15	0.18
Married as of December 1990	0.02	0.02
Occupation (reference = schoolteacher)		
Clerical	0.01	0.01
Laborers	0.01	0
Operatives and craftsmen	0.01	0
Public safety/defense	0.01	0
Mid-level business support	0.01	0.01
Financial service professionals	0.01	0.01
Buy/sell occupations	0.01	0.01
Professional practice (MD/LLB)	0.01	0.01
Licensed medical/health	0.01	0.01
Other educator/human services worker	0.01	0.01
Health/recreation services support	0	0.01
Computer-related occupations	0.01	0.01
Science/technical	0.01	0.01
Knowledge workers, NEC (not elsewhere classified)	0.01	0.01
Communications occupations	0.01	0.01
Arts-based occupations	0	0.01
Managers	0.01	0.01
Supervisor/administrator	0.01	0.01
Other occupation, NEC	0	0

Table B1—Standard errors for table 1: Means for variables used in the regression models, by sex —Continued

	Male	Female
Industry (reference = manufacturing)		
Agriculture or mining	0.01	0
Construction	0.01	0
Public utilities	0.01	0.01
Wholesale trade	0.01	0
Retail trade	0.01	0.01
Finance	0.01	0.01
Business services	0.01	0.01
Personal services	0.01	0.01
Recreation services	0.01	0.01
Professional services	0.01	0.02
Public administration	0.01	0.01
Engineering major in engineering occupation	0.01	0.01
Health science major in health occupation	0	0.01
Imputations		
Imputed FTE/faculty ratio	0.01	0.01
Imputed ratio of applicants to acceptances	0.02	0.02
Imputed per capita expenditure on instruction	0.01	0.01
Imputed log total FTE enrollment	0.01	0
Imputed family income	0.01	0.01

*Cooperative Institutional Research Project measure based on revisions by the Office of Education Research and Improvement (OERI).

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Table B2—Standard errors for table 2: Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for male 1980 high school sophomores who earned a bachelor's degree[1]

Model	(1)	(2)	(3)	(4)
Model R^2	.206 *	.245 *	.369 *	.470 *
Incremental R^2				
Institutional characteristics[a]	.049 *	.028 *	.020 *	.020 *
Higher education experiences[a]			.123 *	.043 *
Background characteristics[a]		.039 *	.034 *	.031 *
Intercept	0.374	0.368	2.863	2.736
Institutional characteristics				
CIRP selectivity (reference = "non-selective")[2]				
CIRP highly selective	0.119	0.113	0.102	0.098
CIRP selective	0.048	0.048	0.045	0.041
FTE/faculty ratio	0.004	0.004	0.004	0.004
Ratio of applicants to acceptances	0.026	0.026	0.025	0.021
Natural log total FTE enrollment	0.024	0.024	0.021	0.019
Percent of total FTE who were graduate students	0.003	0.003	0.003	0.003
Control of school is private, not-for-profit	0.050	0.051	0.046	0.046
School located in Mid-Atlantic/New England	0.043	0.042	0.038	0.035
Carnegie classification				
Carnegie class research university I	0.061	0.060	0.054	0.046
Carnegie class research university II	0.067	0.064	0.058	0.057
Carnegie class liberal arts college I	0.107	0.109	0.107	0.105
Private, not-for-profit research university I	0.117	0.119	0.115	0.100
Private, not-for-profit research university II	0.111	0.129	0.103	0.094
Per capita (FTE) expenditure on instruction ($1000s)	0.012	0.035	0.009	0.009
Per capita (FTE) expenditure on student services ($1000s)	0.034	0.000	0.031	0.027
Historically black college or university	0.156	0.177	0.153	0.143
Higher education experiences				
GPA (on 4-point scale)	(‡)	(‡)	0.040	0.037
Number of mathematics credits at calculus level or above	(‡)	(‡)	0.009	0.009
Course-taking diversity	(‡)	(‡)	0.006	0.005
Number of community college credits	(‡)	(‡)	0.001	0.001
Major field of study (reference = business)				
Education or library sciences	(‡)	(‡)	0.063	0.063
Engineering, architecture, or engineering technology	(‡)	(‡)	0.052	0.076
Physical sciences	(‡)	(‡)	0.088	0.090
Mathematics or computer sciences	(‡)	(‡)	0.050	0.056
Life sciences	(‡)	(‡)	0.111	0.099
Health sciences/health services	(‡)	(‡)	0.075	0.095
Humanities	(‡)	(‡)	0.084	0.083
Arts/applied arts	(‡)	(‡)	0.084	0.100
Social sciences	(‡)	(‡)	0.055	0.054
Applied social sciences	(‡)	(‡)	0.057	0.055
Other	(‡)	(‡)	0.097	0.101

Table B2—Standard errors for table 2: Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for male 1980 high school sophomores who earned a bachelor's degree[1]—Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.206 *	.245 *	.369 *	.470 *
Incremental R^2				
Institutional characteristics[a]	.049 *	.028 *	.020 *	.020 *
Higher education experiences[a]			.123 *	.043 *
Background characteristics[a]		.039 *	.034 *	.031 *
Postgraduate education (reference = bachelor's only)				
Postbachelor's coursework	(‡)	(‡)	0.048	0.046
Incomplete graduate degree	(‡)	(‡)	0.093	0.074
Master's degree	(‡)	(‡)	0.061	0.060
First-professional degree	(‡)	(‡)	0.112	0.208
Ph.D.	(‡)	(‡)	0.176	0.191
Year received bachelor's degree	(‡)	(‡)	0.031	0.030
Background characteristics				
Family income (in thousands)	(‡)	0.001	0.001	0.001
High school academic orientation scale score	(‡)	0.022	0.025	0.023
High school type (reference = public)				
Attended Catholic high school	(‡)	0.043	0.042	0.039
Attended private high school	(‡)	0.093	0.096	0.090
High school urbancity (reference = suburban)				
High school located in urban/central city area	(‡)	0.055	0.049	0.042
High school located in rural/non-SMSA area	(‡)	0.044	0.043	0.040
Total high school enrollment	(‡)	0.000	0.000	0.000
Number of high school extracurricular activities served as leader	(‡)	0.013	0.011	0.010
Race/ethnicity (reference = white, non-Hispanic)				
Black, non-Hispanic	(‡)	0.074	0.067	0.062
Hispanic	(‡)	0.062	0.063	0.053
Asian/Pacific Islander	(‡)	0.083	0.080	0.076
American Indian/Alaskan Native	(‡)	0.235	0.172	0.172
Black, non-Hispanic, attended high school in South	(‡)	0.136	0.116	0.110
Labor market characteristics				
Number of months employed since bachelor's	0.001	0.001	0.003	0.003
Number of months employed at 1991 job	0.001	0.001	0.001	0.001
Number of months employed in 1991	0.026	0.025	0.020	0.019
Total number of months unemployed since bachelor's	0.008	0.007	0.007	0.006
Married as of December 1990	0.032	0.032	0.029	0.025
Occupation (reference = schoolteacher)				
Clerical	(‡)	(‡)	(‡)	0.158
Laborers	(‡)	(‡)	(‡)	0.123
Operatives and craftsmen	(‡)	(‡)	(‡)	0.131
Public safety/defense	(‡)	(‡)	(‡)	0.088
Mid-level business support	(‡)	(‡)	(‡)	0.100
Financial service professionals	(‡)	(‡)	(‡)	0.094
Buy/sell occupations	(‡)	(‡)	(‡)	0.088
Professional practice (MD/LLB)	(‡)	(‡)	(‡)	0.207
Licensed medical/health	(‡)	(‡)	(‡)	0.303
Other educator/human services worker	(‡)	(‡)	(‡)	0.130
Health/recreation services support	(‡)	(‡)	(‡)	0.106
Computer-related occupations	(‡)	(‡)	(‡)	0.086

Table B2—Standard errors for table 2: Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for male 1980 high school sophomores who earned a bachelor's degree[1]—Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.206 *	.245 *	.369 *	.470 *
Incremental R^2				
Institutional characteristics[a]	.049 *	.028 *	.020 *	.020 *
Higher education experiences[a]			.123 *	.043 *
Background characteristics[a]		.039 *	.034 *	.031 *
Science/technical	(‡)	(‡)	(‡)	0.096
Knowledge workers, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	0.118
Communications occupations	(‡)	(‡)	(‡)	0.150
Arts-based occupations	(‡)	(‡)	(‡)	0.135
Managers	(‡)	(‡)	(‡)	0.116
Supervisor/administrator	(‡)	(‡)	(‡)	0.088
Other occupation, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	0.112
Industry (reference = manufacturing)				
Agriculture or mining	(‡)	(‡)	(‡)	0.113
Construction	(‡)	(‡)	(‡)	0.061
Public utilities	(‡)	(‡)	(‡)	0.055
Wholesale trade	(‡)	(‡)	(‡)	0.074
Retail trade	(‡)	(‡)	(‡)	0.073
Finance	(‡)	(‡)	(‡)	0.045
Business services	(‡)	(‡)	(‡)	0.064
Personal services	(‡)	(‡)	(‡)	0.067
Recreation services	(‡)	(‡)	(‡)	0.095
Professional services	(‡)	(‡)	(‡)	0.055
Public administration	(‡)	(‡)	(‡)	0.047
Engineering major in engineering occupation	(‡)	(‡)	(‡)	0.088
Health science major in health occupation	(‡)	(‡)	(‡)	0.322

[a]Statistical significance of model and incremental R^2 based on the F-test for the joint hypothesis that each variable in the combined model or the group of variables has a zero coefficient. The incremental R^2 is the change associated with including a particular group of variables compared with a model without that group.

[1]All equations estimated using a sample of 1,128 male 1980 sophomores who earned a bachelor's degree by 1990, who were not enrolled in graduate school in 1991, and who had positive earnings in 1991.

[2]Cooperative Institutional Research Project measure based on revisions by the Office of Education Research and Improvement (OERI).

*Significant at $p < .05$.

‡Variable not included in estimate.

NOTE: Other variables included in the models include dummy variables to indicate that the values of variables are missing and have been imputed for FTE (full-time-equivalent students) per faculty member, applications to acceptances ratio, FTE expenditure on instruction, total FTE, and family income. See table 1 for the proportion of cases imputed. The coefficients in this table (times 100) are the approximate percentage change in annual earnings in 1991 of a one-unit change in the variable, while the other variables remain unchanged. For example, the coefficient for months employed worked since receiving the bachelor's degree in model 1 shows that while the other variables in the model remained unchanged, each additional month worked was associated with a .46 percent increase in annual earnings. The coefficients for dummy variables show the percentage difference in annual earnings for those with a particular characteristic compared with the mean annual earnings for the reference category. For example, the coefficient for education or library science majors in model 3 shows that while other variables remained unchanged, education or library science majors earned about 22 percent less than the business majors.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Table B3—Standard errors for table 3: Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for female 1980 high school sophomores who earned a bachelor's degree[1]

Model	(1)	(2)	(3)	(4)
Model R^2	.297 *	.322 *	.379 *	.467 *
Incremental R^2				
Institutional characteristics[a]	.074 *	.055 *	.054 *	.041 *
Higher education experiences[a]			.057 *	.030 *
Background characteristics[a]		.025 *	.022 *	.017 *
Intercept	0.403	0.415	3.675	3.225
Institutional characteristics				
CIRP selectivity (reference = "non-selective")[2]				
CIRP highly selective	0.206	0.199	0.202	0.173
CIRP selective	0.063	0.063	0.062	0.055
FTE/faculty ratio	0.005	0.005	0.005	0.005
Ratio of applicants to acceptances	0.041	0.040	0.042	0.044
Natural log total FTE enrollment	0.033	0.034	0.033	0.031
Percent of total FTE who were graduate students	0.004	0.004	0.004	0.004
Control of school is private, not-for-profit	0.074	0.076	0.068	0.064
School located in Mid-Atlantic/New England	0.046	0.046	0.046	0.043
Carnegie classification				
Carnegie class research university I	0.080	0.078	0.075	0.073
Carnegie class research university II	0.066	0.065	0.063	0.064
Carnegie class liberal arts college I	0.120	0.122	0.115	0.110
Private, not-for-profit research university I	0.128	0.130	0.124	0.123
Private, not-for-profit research university II	0.193	0.183	0.155	0.155
Per capita (FTE) expenditure on instruction ($1000s)	0.013	0.012	0.012	0.012
Per capita (FTE) expenditure on student services ($1000s)	0.071	0.076	0.065	0.059
Historically black college or university	0.104	0.101	0.102	0.089
Higher education experiences				
GPA (on 4-point scale)	(‡)	(‡)	0.049	0.045
Number of mathematics credits at calculus level or above	(‡)	(‡)	0.021	0.016
Course-taking diversity	(‡)	(‡)	0.008	0.007
Number of community college credits	(‡)	(‡)	0.001	0.001
Major field of study (reference = business)				
Education or library sciences	(‡)	(‡)	0.070	0.087
Engineering, architecture, or engineering technology	(‡)	(‡)	0.132	0.157
Physical sciences	(‡)	(‡)	0.167	0.165
Mathematics or computer sciences	(‡)	(‡)	0.069	0.073
Life sciences	(‡)	(‡)	0.078	0.080
Health sciences/health services	(‡)	(‡)	0.067	0.140
Humanities	(‡)	(‡)	0.079	0.077
Arts/applied arts	(‡)	(‡)	0.112	0.132
Social sciences	(‡)	(‡)	0.066	0.067
Applied social sciences	(‡)	(‡)	0.070	0.075
Other	(‡)	(‡)	0.185	0.150

Table B3—Standard errors for table 3: Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for female 1980 high school sophomores who earned a bachelor's degree[1]—Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.297 *	.322 *	.379 *	.467 *
Incremental R^2				
Institutional characteristics[a]	.074 *	.055 *	.054 *	.041 *
Higher education experiences[a]			.057 *	.030 *
Background characteristics[a]		.025 *	.022 *	.017 *
Postgraduate education (reference = bachelor's only)	(‡)	(‡)	0.064	0.061
Postbachelor's coursework	(‡)	(‡)	0.096	0.090
Incomplete graduate degree	(‡)	(‡)	0.064	0.061
Master's degree	(‡)	(‡)	0.155	0.298
First-professional degree	(‡)	(‡)	0.124	0.153
Ph.D.	(‡)	(‡)	0.041	0.036
Year received bachelor's degree	(‡)	(‡)	0.030	0.030
Background characteristics				
Family income (in thousands)	(‡)	0.001	0.001	0.001
High school academic orientation scale score	(‡)	0.030	0.034	0.033
High school type (reference = public)				
Attended Catholic high school	(‡)	0.050	0.051	0.045
Attended private high school	(‡)	0.090	0.091	0.072
High school urbanicity (reference = suburban)				
High school located in urban/central city area	(‡)	0.049	0.050	0.045
High school located in rural/non-SMSA area	(‡)	0.049	0.045	0.042
Total high school enrollment	(‡)	0.000	0.000	0.000
Number of high school extracurricular activities served as leader	(‡)	0.013	0.013	0.013
Race/ethnicity (reference = white, non-Hispanic)				
Black, non-Hispanic	(‡)	0.066	0.067	0.071
Hispanic	(‡)	0.052	0.053	0.054
Asian/Pacific Islander	(‡)	0.085	0.081	0.072
American Indian/Alaskan Native	(‡)	0.413	0.436	0.404
Black, non-Hispanic, attended high school in South	(‡)	0.093	0.093	0.085
Labor market characteristics				
Number of months employed since bachelor's	0.002	0.002	0.003	0.003
Number of months employed at 1991 job	0.001	0.001	0.001	0.001
Number of months employed in 1991	0.020	0.019	0.020	0.018
Total number of months unemployed since bachelor's	0.006	0.006	0.006	0.006
Married as of December 1990	0.039	0.039	0.038	0.037
Occupation (reference = schoolteacher)				
Clerical	(‡)	(‡)	(‡)	0.099
Laborers	(‡)	(‡)	(‡)	0.184
Operatives and craftsmen	(‡)	(‡)	(‡)	0.247
Public safety/defense	(‡)	(‡)	(‡)	0.102
Mid-level business support	(‡)	(‡)	(‡)	0.110
Financial service professionals	(‡)	(‡)	(‡)	0.090
Buy/sell occupations	(‡)	(‡)	(‡)	0.089
Professional practice (MD/LLB)	(‡)	(‡)	(‡)	0.312
Licensed medical/health	(‡)	(‡)	(‡)	0.136
Other educator/human services worker	(‡)	(‡)	(‡)	0.231
Health/recreation services support	(‡)	(‡)	(‡)	0.093

Table B3—Standard errors for table 3: Coefficients for the regression of log 1991 annual earnings on selected postsecondary institution characteristics, higher education experiences, background characteristics, and labor market characteristics for female 1980 high school sophomores who earned a bachelor's degree[1]—Continued

Model	(1)	(2)	(3)	(4)
Model R^2	.297 *	.322 *	.379 *	.467 *
Incremental R^2				
Institutional characteristics[a]	.074 *	.055 *	.054 *	.041 *
Higher education experiences[a]			.057 *	.030 *
Background characteristics[a]		.025 *	.022 *	.017 *
Computer-related occupations	(‡)	(‡)	(‡)	0.095
Science/technical	(‡)	(‡)	(‡)	0.106
Knowledge workers, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	0.135
Communications occupations	(‡)	(‡)	(‡)	0.122
Arts-based occupations	(‡)	(‡)	(‡)	0.142
Managers	(‡)	(‡)	(‡)	0.092
Supervisor/administrator	(‡)	(‡)	(‡)	0.096
Other occupation, not elsewhere classified (NEC)	(‡)	(‡)	(‡)	0.143
Industry (reference = manufacturing)				
Agriculture or mining	(‡)	(‡)	(‡)	0.122
Construction	(‡)	(‡)	(‡)	0.141
Public utilities	(‡)	(‡)	(‡)	0.063
Wholesale trade	(‡)	(‡)	(‡)	0.099
Retail trade	(‡)	(‡)	(‡)	0.074
Finance	(‡)	(‡)	(‡)	0.071
Business services	(‡)	(‡)	(‡)	0.090
Personal services	(‡)	(‡)	(‡)	0.077
Recreation services	(‡)	(‡)	(‡)	0.142
Professional services	(‡)	(‡)	(‡)	0.068
Public administration	(‡)	(‡)	(‡)	0.076
Engineering major in engineering occupation	(‡)	(‡)	(‡)	0.211
Health science major in health occupation	(‡)	(‡)	(‡)	0.182

[a]Statistical significance of model and incremental R^2 based on the F-test for the joint hypothesis that each variable in the combined model or the group of variables has a zero coefficient. The incremental R^2 is the change associated with including a particular group of variables compared with a model without that group.

[1]All equations estimated using a sample of 1,128 male 1980 sophomores who earned a bachelor's degree by 1990, who were not enrolled in graduate school in 1991, and who had positive earnings in 1991.

[2]Cooperative Institutional Research Project measure based on revisions by the Office of Education Research and Improvement (OERI).

*Significant at $p < .05$.

‡Variable not included in estimate.

NOTE: Other variables included in the models include dummy variables to indicate that the values of variables are missing and have been imputed for FTE (full-time-equivalent students) per faculty member, applications to acceptances ratio, FTE expenditure on instruction, total FTE, and family income. See table 1 for the proportion of cases imputed. The coefficients in this table (times 100) are the approximate percentage change in annual earnings in 1991 of a one-unit change in the variable, while the other variables remain unchanged. For example, the coefficient for months employed worked since receiving the bachelor's degree in model 1 shows that while the other variables in the model remained unchanged, each additional month worked was associated with a .46 percent increase in annual earnings. The coefficients for dummy variables show the percentage difference in annual earnings for those with a particular characteristic compared with the mean annual earnings for the reference category. For example, the coefficient for education or library science majors in model 3 shows that while other variables remained unchanged, education or library science majors earned about 22 percent less than the business majors.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Table B4—Standard errors for table 4: Average number of months 1980 sophomores were employed at all jobs since college graduation, and the average number of months worked at 1991 job, by postsecondary attainment

	Bachelor's	Post graduate coursework	Incomplete graduate degree	Master's	First professional
Months employed since bachelor's	0.48	1.21	1.90	1.26	2.71
Months employed at 1991 job	0.68	1.80	2.74	1.69	2.08

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Table B5—Standard errors for table 5: Mean earnings by occupation for 1980 sophomores who earned a bachelor's degree, by sex: 1991

	Male	Female
Total	600	469
Clerical	—	1,238
Laborers	5,135	—
Operatives and craftsmen	—	—
Public safety/defense	1,720	—
Mid-level business support	1,311	1,458
Financial service professionals	1,639	1,101
Buy/sell occupations	1,366	1,900
Professional practice (MD/LLB)	2,452	3,144
Licensed medical/health	—	1,151
Schoolteachers	1,316	726
Other education/human services worker	2,526	1,470
Health/recreation services support	—	—
Computer-related occupations	1,464	1,788
Scientific/technical	876	1,920
Knowledge workers, NEC (not elsewhere classified)	3,854	—
Communications occupations	—	1,896
Arts-based occupations	—	1,868
Managers	3,852	2,226
Supervisors/administrators	1,455	1,514
Other occupation, NEC	—	—

—Too few cases for reliable estimate.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Table B6—Standard errors for figure 1: Percentage distribution of major field of study for 1980 high school sophomores who earned a bachelor's degree, by sex

	Male	Female
Business	1.74	1.59
Education or library sciences	0.51	1.13
Engineering, architecture, or engineering technology	1.54	0.50
Physical sciences	0.67	0.65
Mathematics or computer sciences	1.19	0.82
Life sciences	0.72	0.96
Health sciences/services	0.53	1.20
Humanities	0.75	0.97
Arts/applied arts	0.72	0.92
Social sciences	1.36	1.36
Applied social sciences	1.07	1.17
Other	0.47	0.28

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1980 High School and Beyond (HS&B) study, Sophomore Cohort, Fourth Follow-up Survey.

Appendix C—Glossary

This glossary describes the variables used in this report, which come from MERGED.SAV, an analysis file created from High School and Beyond 1980 Sophomore Cohort data. These variables were either items taken directly from the HS&B surveys, or they were derived by combining one or more items in these surveys, with the exception of variables describing the postsecondary institution that awarded the bachelor's degree, and variables describing students' experiences while in college. Institutional characteristics came from the Integrated Postsecondary Education Data System (IPEDS) for 1986, or if data were missing or unavailable for 1986, 1988. In addition, some information about institutions was drawn from the 1986 College Board Annual Survey of Colleges. Postsecondary experience variables were derived from the High School and Beyond Postsecondary Education Transcript Study (PETS) data file dated 4/16/96. For all variables in this glossary, the variable name contained in the analysis file is identified in the right-hand column.

Institutional characteristics are listed first, followed by a section describing the higher education experiences variables. This section is followed by employment and labor market variables. The final section consists of family background variables and high school education variables.

Glossary Index

Industry in 1991 ..... AGMINING / CONSTRCT / MANUFACT / PUBUTIL / WHOLSALE / RETAIL / FINANCE / BUSSERV / PERSERV / RECSERV / PROFSERV / PUBADMIN
Engineering major in an engineering occupation ..... ENGRENGR
Health science major employed in a health occupation .....HLTHNURS

HIGH SCHOOL AND BACKGROUND CHARACTERISTICS

Family income FAMINC2
High school academic orientation scale ..ACADSCAL
Control of high school ..... CATHOLIC / OTHRPVT
Urbanicity of high school.... URBANHS / RURALHS
Total high school enrollment SB002A
Number of high school extracurricular activities served as leader ..... HSLEADER
Race–ethnicity RACE4
Black, non-Hispanic, attended high school in the South .....BLKSOUTH

INSTITUTIONAL CHARACTERISTICS

Cooperative Institutional Research Project selectivity measure **HIGHSEL**
SOMESEL

A dummy variable to indicate the institution was among the most selective. The institutional selectivity index was constructed for the NLS-72 postsecondary transcript study and modified in the course of editing the 1980 Sophomore PETS file to reflect changes during the 1980s. The 1987 selectivity ratings of the Cooperative Institutional Research Project were the principal source of information. The reference category was "nonselective" institutions.

Full-time-equivalent (FTE) student to faculty ratio **STUDFAC**

The ratio of full-time-equivalent (FTE) students to the number of faculty. The number of FTE was equal to the number of full-time students plus one-third the number of part-time students.

Ratio of applicants to acceptances **ACCRATIO**

The ratio of the number of applications for admissions to the number of acceptances reported by the institution.

Natural log of total full-time enrollment **LOGFTE**

The natural logarithm of total full-time enrollment.

Percent of total full-time-equivalent students who were graduate students **PGRFTE**

The percentage of total full-time-equivalent enrollment that was composed of graduate students.

Control of institution was private, not-for-profit **PRIVATE**

A dummy variable that indicates whether or not an institution was privately controlled, not-for-profit. The reference category is all other types of institutional control.

School located in the Mid-Atlantic or New England **EAST**

Attending a postsecondary institution located in the Mid-Atlantic or New England regions is a dummy variable derived from a variable in IPEDS that indicates the state in which an institution is located. Students who attended an institution located in the following states were coded as attending an institution in the Mid-Atlantic or New England: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

Carnegie classification **RESI**
RESII
LIBARTI

The following text is from the documentation provided by the Carnegie Foundation for the Advancement of Teaching. Copies of the book *A Classification of Institutions of Higher Education* (with a foreword by Ernest L. Boyer), 1994 edition are available from:

Jossey-Bass Publishers
P.O. Box 70624
Chicago, IL 60673-0624

As explained in the foreword, the Carnegie Classification was developed by Clark Kerr in 1970, primarily to improve the precision of the Carnegie Commission's research. The classification is NOT intended to establish a hierarchy among higher learning institutions. Rather, the aim is to cluster institutions with similar programs and purposes, and the Carnegie Foundation opposes the use of the classification as a way of making qualitative distinctions among the sectors.

CLASSIFICATION: DEFINITIONS OF TYPES OF INSTITUTIONS

The Carnegie Classification includes all colleges and universities in the United States that are degree-granting and accredited by an agency recognized by the U.S. Secretary of Education. The 1973 version of the Classification described Research Universities I and II as follows:

Research Universities I: The 50 leading universities in terms of federal financial support of academic science in at least two of the three academic years, 1968–69, 1969–70, and 1970–71, provided they awarded at least 50 Ph.D.s in 1969–70.

Research Universities II: These universities were on the list of 100 leading institutions in terms of federal financial support in at least two out of the above three years and awarded at least 50 Ph.D.s in 1969–70 or they were among the leading 50 institutions in terms of the total number of Ph.D.s awarded during the years from 1960–61 to 1969–70.

Liberal Arts Colleges I: These colleges scored 5 or above on Astin's selectivity index or they were included among the 200 leading baccalaureate-granting institutions in terms of numbers of their graduates receiving Ph.D.s at 40 leading doctoral-granting institutions from 1920 to 1966.

The Carnegie Classifications for the PETS sample were modified by Clifford Adelman of OERI to take account of a more varied universe of institutional types than the original Carnegie Classification covers. Reference points on institutional type were to the 1983 and1987 Higher Education General Information Survey (HEGIS) files and 1991 IPEDS.

Three dummy variables were created to indicate that an institution was a Research University, Class I (RESI, code "11" on the PETS variable CCLASS); a Research University, Class II (RESII, code "12"); or a Liberal Arts, Class I (LIBARTI, code "31").

Private, not-for-profit, Carnegie class research university **PVTRESI**
PVTRESII

Two dummy variables were created for the combination of private, not-for-profit control, and classification as a Carnegie Research University, Class I (PVTRESI) or a Carnegie Research University, Class II (PVTRESII).

Per capita (FTE) expenditure on instruction **PERCPINS**

This measure was calculated by dividing the IPEDS amount of total expenditures for instructional purposes by the total number of FTE enrollment. This measure was scaled to reflect expenditures in thousands of dollars per FTE in the regression models.

Per capita (FTE) expenditures on student services **PERCPSS**

This measure was calculated by dividing the amount shown in IPEDS for student services by the total number of FTE enrollment. IPEDS defines student services as all expenditures for activities whose primary purpose is to contribute to students' emotional and physical well-being and to their intellectual, cultural, and social development outside the context of the formal instructional program. This measure was scaled to reflect expenditures in thousands of dollars per FTE in the regression models.

Historically black college or university **HBCFLAG**

Earning a bachelor's degree at an historically black college or university was represented by a dummy variable in the PETS file (HBCFLAG).

POSTSECONDARY EDUCATION EXPERIENCES

Grade point average (GPA) **GPA**

Grade point average (GPA) was calculated from postsecondary transcripts. All grading systems were standardized to a 4.0 scale.

Credits in calculus or calculus-based courses **MATHCAL2**

A count of the number of earned credits shown on postsecondary transcripts in calculus or calculus-based courses. The taxonomy of postsecondary courses was used to identify calculus and calculus-based courses (Adelman 1995). Only credits in the following courses were included:

270601 Calculus, Linear Algebra, Differential Equations, Calculus II, Calculus III, Calculus IV
270602 Calculus for Life Sciences/Economics/Business, Short Calculus, Calculus for Technology, Applied Calculus, Calculus for Decision-Making
400830 Physics with Calculus, Math Methods in Physics

Course-taking diversity **NTWODIG**

A count of the number of content areas in which students took courses shows the breadth of curricular offerings represented on the postsecondary transcripts. The variable was created by counting the number of different first-two-digit entries in the course file of the PETS.

Number of community college credits **COMMCRDT**

The number of credits earned at a community college prior to earning the bachelor's degree based on the postsecondary transcripts.

Major field of study for the bachelor's degree

Major field of study shown on the postsecondary transcripts, represented by a series of 12 dummy variables. The reference group is business or management (BAMJR1).

Education or library science	**BAMJR2**
Engineering, architecture, or engineering technologies	**BAMJR3**
Physical sciences	**BAMJR4**
Mathematics or computer sciences	**BAMJR5**
Life sciences	**BAMJR6**
Health sciences, health services	**BAMJR7**
Humanities	**BAMJR8**
Arts or applied arts	**BAMJR9**
Social sciences	**BAMJR10**
Applied social sciences	**BAMJR11**
Other majors	**BAMJR12**

Postgraduate education

The PETS variable NHDEG represents the highest attainment represented on the postsecondary transcripts. A series of 5 dummy variables based on NHDEG were used to represent this attainment in the multivariate models. The reference category is no confirmed postsecondary education beyond the bachelor's degree. Postsecondary attainment was assessed as of 1991.

Post-bachelor's coursework, NHDEG = 5	**CRSEWORK**
Incomplete graduate degree, NHDEG = 6	**INCOMP**
Master's degree, NHDEG = 7	**MASTERS**
First professional degree, NHDEG = 8	**FIRSTPRO**
Ph.D., NHDEG = 9	**PHD**

Year received bachelor's degree **BAYEAR**

The year the bachelor's degree was awarded as shown on the postsecondary transcripts. The value for this variable is the last two digits of the calendar year (e.g., 86 for 1986). The analysis sample was restricted to 1980 sophomores who earned a bachelor's degree by 1990.

LABOR MARKET EXPERIENCES

Number of months employed since bachelor's degree **EMP_BA**

Number of months employed between award of the bachelor's degree and December 1991. This variable was created using monthly employment status variables on the PETS file (LFS0186 through LFS1291). For dates prior to January 1986, monthly employment status indicators were based on dates of employment given in the Second and Third Follow-up surveys (SY46 through SY49, TY8 through TY11).

Number of months employed at 1991 job **MO91EMP**

The number of months worked at the job held in 1991 since January 1986 was derived based on the PETS labor force status variables LFS0186 to LFS1291, and two variables from the Fourth Follow-up survey, Y4304A (the

number of years at current or most recent job) and Y4304B (the number of months at the current or most recent job). Valid responses had to include non-missing entries for both of these variables.

Number months employed during 1991 **EMP91**

Number of months of employment during 1991 based on PETS variable LFS1291.

Number of months unemployed since bachelor's degree **UNEMP_BA**

The count of the number of months of unemployment since award of the bachelor's degree through December 1991 was constructed using the same variables as EMP_BA, above.

Marital status as of December 1990 **MAR1290**

This is a dummy variable indicating whether the respondent was married or unmarried in December of 1990. Marital status was determined from items on the Second Follow-up through Fourth Follow-up surveys which asked respondents about the beginning and ending dates of each marriage.

Occupation in 1991

Occupation was derived from responses to the PETS variable OCCUP91. Nineteen dummy variables for major occupational groups were constructed. The reference category was schoolteacher.

Clerical	**CLERICAL**
Laborers	**LABORER**
Operatives and craftsmen	**OPSCRAFT**
Public safety/defense	**PUBSAFE**
Mid-level Business support	**MIDLEVL**
Financial services professionals	**FINLSRV**
Buy/sell occupations	**BUYSELL**
Professional practice (lawyers, judges, physicians, dentists, etc.)	**PROFPRAC**
Licensed medical/health occupations	**LICMEDOC**
Other educator/human services worker	**OTHEDUC**
Health/recreation services support	**HEALTHRC**
Computer-related occupations	**COMPRELT**
Science/technical	**SCITECH**
Knowledge workers, not elsewhere classified	**KNOWLEDG**
Communication occupations	**COMMOCS**
Arts-based occupations	**ARTSBASE**
Managers	**MANAGERS**
Supervisor/administrator	**SUPADMIN**
Other occupation, not elsewhere classified	**OTHER**

Industry in 1991

The industry for the job held in 1991 was based on the HS&B Fourth Follow-up variable Y4303C9. Eleven dummy variables were created for the multivariate analyses, with manufacturing (both durable and non-durable) the reference category.

Agriculture or mining	**AGMINING**
Construction	**CONSTRCT**
Public utilities	**PUBUTIL**
Wholesale trade	**WHOLSALE**
Retail trade	**RETAIL**
Finance	**FINANCE**
Business services	**BUSSERV**
Personal services	**PERSERV**
Recreation services	**RECSERV**
Professional services	**PROFSERV**
Public administration	**PUBADMIN**

Engineering major employed in an engineering occupation **ENGRENGR**

This dummy variable was created to indicate that the major field of study for the baccalaureate was engineering and that the 1991 detailed occupation (OCCUP91 from the HS&B Fourth Follow-up survey) was coded 127 (engineering). All other combinations were set to zero.

Health science major employed in a health occupation **HLTHNURS**

This dummy variable was created to indicate that the major field of study for the baccalaureate was health sciences or health services (BAMJR7) and that the 1991 detailed occupation (OCCUP91 from the HS&B Fourth Follow-up survey) was coded 122. Occupation code 122 includes registered nurses, pharmacists, dental hygienists, X-ray/MRI/etc. technologists, physical and other therapists, speech pathologists, opticians, and so on.

HIGH SCHOOL AND BACKGROUND CHARACTERISTICS

Family income **FAMINC2**

Total family income was obtained during the Base-Year and First Follow-up survey coded into the following categories:

1 Less than $8,000
2 $8,000–$14,999
3 $15,000–$19,999
4 $20,000–$24,999
5 $25,000–$29,999
6 $30,000–$39,999
7 $40,000–$49,999
8 $50,000 and more

For the multivariate analyses, the income ranges were recoded to the midpoint of the intervals and divided by 1,000. A Pareto estimator was used to estimate the midpoint of the open-ended interval ($50,000 and more).

High school academic orientation scale **ACADSCAL**

Pre-collegiate academic experience was measured by standardizing each of the following three variables and summing them to form an academic orientation score:

High school grade point average from the HS&B high school transcripts, the HS&B cognitive test score, and the average SAT score.

Control of high school

Two dummy variables, based on HSTYPE, were included in the multivariate analyses to represent Catholic and other private high schools. The variables were created as follows:

Attended a Catholic high school, HSYPE = 2	**CATHOLIC**
Attended a non-Catholic private high school, HSTYPE = 3	**OTHRPVT**

Urbanicity of high school

The urbanicity of the high school attended by 1980 sophomores is represented by the variable PHSURBAN on the PETS data file. Two dummy variables were created for the multivariate analyses, with the reference category being high schools located in a suburb in an SMSA, not a central city.

High school located in urban or central city area	**URBANHS**
High school located in a rural area or non-SMSA	**RURALHS**

Total high school enrollment **SB002A**

Total high school enrollment from the questionnaire sent to participating high schools in the base year of the HS&B study.

Number of high school extracurricular activities served as a leader **HSLEADER**

During the First Follow-up survey, 1980 sophomores were asked if they participated actively, participated as a leader, or did not participate in a number of different kinds of extracurricular organizations. A count of the number of organizations in which they served as a leader was calculated using the following items:

FY38A Participation in varsity athletic teams
FY38B Participation in other athletic teams
FY38C Participation in cheer leading, pep club
FY38D Participation in debating or drama
FY38E Participation in band or orchestra
FY38F Participation in chorus or dance
FY38G Participation in hobby clubs
FY38H Participation in honorary clubs
FY38I Participation in school newspaper, yearbook
FY38J Participation in school subject-matter clubs
FY38K Participation in student council, government
FY38L Participation in vocational education clubs
FY38M Participation in youth community organizations
FY38N Participation in church activities, youth groups
FY38O Participation in junior achievement
FY38P Participation in service clubs, community service activities
FY38Q Participation in sororities, fraternities

Race–ethnicity **RACE4**

Asian or Pacific Islander	A person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or Pacific Islands. This includes people from China, Japan, Korea, the Philippine Islands, Samoa, India, and Vietnam.
Black, non-Hispanic	A person having origins in any of the black racial groups of Africa, not of Hispanic origin.
White, non-Hispanic	A person having origins in any of the original peoples of Europe, North Africa, or the Middle East (except those of Hispanic origin).
Hispanic	A person of Mexican, Puerto Rican, Cuban, Central or South America or other Spanish culture or origin, regardless of race.
American Indian/Alaskan Native	A person having origins in any of the original peoples of North America and who maintain cultural identification through tribal affiliation or community recognition.

For the multivariate analyses, dummy variables for Asian/Pacific Islander, Black, non-Hispanic, Hispanic, and American Indian/Alaskan Native were constructed. The reference category was white, non-Hispanic.

Black, non-Hispanic, attended high school in the South **BLKSOUTH**

An indicator variable for attending a high school in the South and being black, non-Hispanic was derived using the race-ethnicity variable (RACE4) and the region where the high school was located (HSREG).