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AUTHOR Thomas, Scott L.
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ABSTRACT

This study examined college graduates' earnings and indebtedness one year after graduation. First, data from the first follow-up of the Baccalaureate & Beyond study (which followed a nationally representative sample of baccalaureate graduates from 1993) were used to describe the earnings distribution of full-time workers from various academic major areas. Second, a multi-level earnings model that incorporated demographic, family background, education, and labor market variables was developed; and, third, student indebtedness and student debt-to-earnings ratios were related to several individual-level and institutional-level variables (primarily from the Integrated Postsecondary Education Data System, 1993). Hierarchical linear modeling was used for data analysis. Results found three major influences on the initial earnings of college graduates and their debt ratios: (1) college major, with health-related and engineering majors earning the most and education and humanities majors the least; (2) college performance, as measured by grade point average, which had a positive impact on earnings and a negative impact on debt ratios; and (3) college quality, as measured by selectivity, which affected initial earnings but not debt ratios. (Contains 76 references and 7 tables.) (DB)

Deferred Costs and Economic Returns to College Major, Quality, and Performance: recent trends

Scott L. Thomas

University of Hawai'i at Mānoa
Department of Educational Administration

University of Hawaii at Manoa
1776 University Avenue
Honolulu, HI 96822

scthomas@hawaii.edu
www2.hawaii.edu/~scthomas/ashe98p2.htm

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Headquartered at the University of Missouri-Columbia • College of Education • Department of Educational Leadership and Policy Analysis • 211 Hill Hall, Columbia, MO 65211 • 573-882-9645 • fax 573-884-5714

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Abstract

This study explores recent graduates' earnings and indebtedness one year after graduation. Data for this research come from the first follow-up of NCES' Baccalaureate & Beyond study, a nationally representative sample of baccalaureate graduates from 1993. Results suggest distinct patterns in graduates' debt to income ratios, which vary by academic major, grade performance, and type of institution attended.

INTRODUCTION

Institutional diversity is a hallmark of the American higher education system. In 1995 there were over 3700 institutions of higher education (IHE) in the United States and its territories, enrolling roughly 14 million students (National Center for Education Statistics, 1998 tables 172 and 241). Unlike systems of higher education in many countries, in the United States, it is comprised of institutions that vary dramatically in terms of size, geography, sector, selectivity, and mission. The institutions take the form of campuses ranging from flagship state universities to private liberal arts colleges and two-year community colleges. This diversity ensures most Americans access to some facet higher education. This is evidenced by the growing college going rate of the nation's high school graduates, which currently stands at 65 percent (National Center For Education Statistics, 1998 table 184).

In an economic sense, it is a buyer's market as better-qualified prospective students weigh their alternatives in this higher education marketplace. Sociologists and economists have shown that many factors affect student predisposition to attend college as well as decisions to attend particular institutions (e.g., Chapman, 1979; Fuller, Manski and Wise, 1982; Hearn, 1990; Sewell and Hauser, 1975, Sewell and Shah, 1978). Ability and achievement, family socioeconomic status, academic orientation of the high school program, and student aspiration are among the factors that have a demonstrable impact on student predisposition to attend college after high school rather than engaging in some alternate activity such as entering the workforce. Once so disposed, factors such as net cost, academic quality, ability, and family socioeconomic status enter into the calculus of determining which IHE to attend (Hearn, 1990; Hossler, Braxton, and Coopersmith, 1989; Paulsen, 1990).

Underlying these choices is the notion that college graduates are likely to receive some type of positive return to college attendance – a return greater than that realized by engaging in alternate activities. The common wisdom is well documented concerning the financial benefits of attending college despite uncertainty about the accuracy of students' expectations in this regard. (Betts, 1996; Hanushek, 1993; Manski, 1993; Smith and Powell, 1990; Sumner and Brown, 1996). Indeed volumes of research have accumulated which document the myriad benefits accruing to college graduates. These benefits are far reaching ranging from enhanced self-esteem to improved health (Pascarella and Terenzini, 1991). While, consciously or subconsciously, such ends undoubtedly figure into prospective students' decision whether or not to attend college, perhaps the most commonly cited reason is much more extrinsic: to make more money (Cooperative Institutional Research Program, 1997). And certainly there is a financial payoff to college attendance. Not only are college graduates less likely than high school graduates to

experience periods of unemployment but they also enjoy significant wage premiums over their lifetimes. In 1993 for example, those older than 18 with bachelor's degrees earned 53 percent more than those whose with only a high school diploma (U.S. Bureau of the Census, 1996).

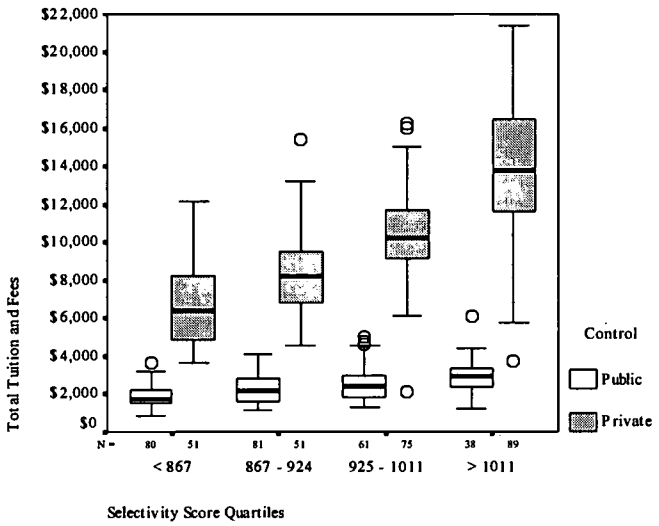
This financial interest is manifest not only in students' decision to attend college but students' subsequent choice of academic major as well. This is evidenced by a marked shift in the number of professional degrees (often viewed as a ticket to better paying occupations) awarded since the late 1960s (Turner and Bowen, 1990). A large body of research demonstrates that degrees in professional fields such as engineering or business tend to yield higher salaries than students with degrees from other disciplines (Rumberger 1984, Berger 1988a, 1988b; James, Alsalam, Conaty, and To, 1989; Rumberger and Thomas, 1993). Moreover, there is evidence that these differences actually increase over time (Berger, 1988a, 1988b).

The private rate of return to college education, the financial return accruing to individuals (Mincer, 1974; Leslie and Brinkman, 1988; Psacharopoulos 1973), has been the focus of a large body of literature that has accumulated over the past 35 years (see Cohn and Hughes, 1994). On the most general level, this literature unequivocally demonstrates the substantial economic return associated with college graduation (e.g., Grubb, 1992; Juhn, Murphy, and Pierce, 1993; Murphy and Welch, 1989; Rupert, Schweitzer, Serverance-Lossin, and Turner, 1996). On a narrower level, other important but less studied relationships have emerged from this work. These include differential returns based on one's academic major area, the "quality" of college from which one graduates as well as the level of the graduate's academic performance (Rumberger and Thomas, 1993). This body of work on private returns has helped define much of the "common wisdom" associating college attendance with higher earnings. One conclusion drawn from this literature is that, all things being equal, if one desired to maximize post-graduate earnings, she would choose a high quality college or university, major in a lucrative area such as health or engineering, and strive to attain a high grade point average over the course of her studies (James *et al.*, 1989).

Of course, all things are not equal, especially when it comes to the financial cost of different paths through college. These paths are determined by a number of socioeconomic factors not the least of which is an individual's expectation of future financial returns resulting from investing in a college education. From a *human capital* perspective, it is desirable that this "investment" in a college education yield financial returns over the course of one's lifetime that will exceed those of the costs of the investment itself (Becker, 1993). The costs associated with this investment are both direct (e.g., tuition and debt service on any long term financing associated with bearing the costs college attendance) and indirect (e.g., foregone earnings). (Mincer, 1975).

The literature on college choice demonstrates that the direct cost of attending a particular college has strong impact on student perceptions of its accessibility. While among non-financial attributes such as location, size, social orientation, and academic quality have been consistently identified as the most important non-financial factors in the college choice process, the net cost of college is the single most important financial determinant (Hossler, Braxton, and Coopersmith, 1989). As in most markets, however, their exists a strong correlation between quality and price. More often than not, more highly selective – higher quality – institutions are also the most expensive (see figure 1). This reality forces prospective students in the choice process to carefully balance concerns over the quality of potential colleges with their costs.

Figure 1. Institutional selectivity vs. tuition and fees



In a human capital framework, part of this balance requires an understanding of the value-added financial benefits of attending higher "quality" institutions. Many have noted the informal prestige hierarchy among U.S. higher education institutions (e.g., Ben-David, 1974; Clark, 1983). Research has shown that graduates from higher quality institutions generally enjoy higher salaries than graduates from lower quality institutions – even after controlling for differences in background and ability (Solomon, 1973, 1975; Trusheim and Crouse, 1981; Smart 1988; Mueller, 1988; James *et al.*, 1989; Rumberger and Thomas, 1993). While consistent, the magnitude of this effect is small. Moreover, it appears that this effect is stronger for students from higher socioeconomic backgrounds (Karabel and McClelland, 1987). Regardless of the significant but minor role in determining future earnings, the common wisdom that higher quality colleges produce graduates who do better in their professional lives appears to be a sufficiently compelling influence as prospective students weigh their college options. In terms of an

investment in human capital, the challenge now facing these prospects is how to maximize the institutional quality dimension given the resources available to cover the associated costs.

Businesses very frequently finance investments in their physical capital. Likewise, many students have turned to financing investments in their human capital through the use of federal student loans, credit cards, friends and family. While at face value this comparison may seem absurd, the skyrocketing cost of college attendance has become daunting for students at most income levels. In 1995, 71 percent of college freshmen expressed concern that they might not be able to pay for the college costs associated with their intended careers (Astin, Korn, Mahoney, and Sax, 1995). With tuition rates outpacing increases in median household income and public college costs, such concern may seem warranted. In fact, rapid tuition increases throughout the 1980s and early 1990s raised concern among members of the US Congress, who directed the General Accounting Office (GAO) to examine this issue and, further, commissioned a panel of experts to report on the rising costs of college. One of the GAO's recent reports resulting from this charge, *Tuition Increasing Faster Than Household Income and Public Colleges' Costs*, concluded that:

> From school year 1980-81 through 1994-95, tuition at 4-year public colleges and universities has risen nearly three times as much as median household income, making college attendance less affordable for many students.
>
> ...
>
> Moreover, increases in grant aid—primarily federal Pell grants—have not kept up with tuition increases at 4-year public colleges and universities. As a result, in addition to paying higher prices, college students and their parents are having to rely more heavily on loans and personal finances. For example, in fiscal year 1980, the average student loan was $518; in fiscal year 1995, it rose to $2,417, an increase of 367 percent. (GAO, 1996 page 6)[1]

Increasingly then, students are borrowing to underwrite their investments in college education. Increased borrowing is the result of both rising tuition costs and relaxed guidelines for participating in federally subsidized student loan programs. Changes in 1992 to the eligibility rules for subsidized federal student loans raised annual loan limits and opened a new unsubsidized student loan program to all students, regardless of income. Some have also noted that while student borrowing has increased substantially since 1992, debt levels vary significantly for graduates from different degree programs (American Council on Education, 1997). Moreover,

[1] The College Board (1998) further documents this shifting reliance on loans from grants in it annual *Trends in Student Aid* report. According to this report, loans make up 60 percent of the pool of grants and loans available to students in 1997-1998, and grants less than 40 percent. The report states that proportions were almost exactly opposite in the late 1970s.

a recent American Council on Education (1997) report shows that debt levels have risen at a much faster rate than college tuition.

The impact of such borrowing is evidenced in a recent survey in which 64 percent of respondents indicated that student loans were "extremely" or "very important" in allowing them to attend the school of their choice. Thirty-nine percent of the respondents reported that their concern over borrowing was extremely or very important in preventing them from attending a more expensive school (Baum and Sanders, 1998). Results such as these underscore the role borrowing plays in students' decisions regarding college.

How much debt is too much is a question that has been debated by legislators and higher education policy makers for over 10 years (e.g., Hansen, 1987; Hansen and Rhodes, 1988; Greiner, 1996). Most commentators on this debate conclude that while debt loads are undoubtedly increasing rapidly, the student debt burden remains manageable, on average (National Center for Education Statistics, 1995; National Center for Education Statistics, 1997; Baum, 1996). Others, however, have suggested that debt is an obstacle to further investments in human capital vis-à-vis education (Fox, 1992; Weiler, 1994). Our current knowledge base, however, is inadequate to assess the degree to which students have incurred debt to pay for their studies in certain disciplines at particular types of institutions and how this debt relates to beginning salaries of these graduates.

This study addresses this void by examining both earnings and indebtedness of college graduates. This examination of the mix of initial earnings, indebtedness related to college, and students' choices of institution and major is designed to advance our understanding of the economic returns to the baccalaureate degree by first providing more refined estimates of these returns and, second, by placing them in a more accurate economic perspective. Unlike most previous studies, this study employs a recent nationally representative sample of college graduates (1992-1993) and uses multilevel statistical methods appropriate to the problem (see Rumberger and Thomas (1993) for an exception to these latter shortcomings).

In this paper, I first use data from Baccalaureate & Beyond, a national sample of recent college graduates, to provide an updated description of the earnings distribution of full-time workers from a number of academic major areas. Second, I develop a multilevel earnings model incorporating demographic, family background, education, and labor market variables in order to examine the impacts of each of these factors on post-graduate earnings. Third, using the subset of students who report indebtedness as a result of the costs of their undergraduate education, I describe indebtedness distributions as well as the distributions of a debt to earnings ratio of these

graduates. Finally, I examine the effects of a number of individual-level and institutional level variables on this debt to earnings ratio.

DATA AND METHODS

The Sample

The study employs hierarchical linear modeling (HLM) techniques due to the multi-level nature (e.g. institutional and individual) of the factors shown to have an effect on the outcomes of interest. Proper analyses of multi-level data require a technique, such as HLM, that more accurately estimates the unique contributions of institutional data on individual level outcomes (Bryk and Raudenbush 1992; Heck and Thomas, in press). The HLM technique accomplishes this by simultaneously estimating two sets of equations, a within-unit set and a between-unit set. Using earnings as an example, the first set estimates the relationship between individual earnings and a series of individual level characteristics within each institution. A second set of estimates expresses the relationship between each regression coefficient from the first set of equations and a series of institutional characteristics between institutions. To estimate these two sets of equations, both individual level data and institutional level data are required.

The individual level data come from the first follow-up of the Baccalaureate and Beyond Study (BB:93/94). The BB:93/94 is part of a national longitudinal study designed to provide information concerning education and work experiences after completion of the bachelor's degree. The first follow-up survey was administered to over 10,000 recent graduates who received a bachelor's degree in 1993.

The B&B:93/94 study is the first in a series of five follow-up interviews of persons who received a bachelor's degree in 1992-1993. The National Postsecondary Student Aid Study (NPSAS:93) provided the baseline sample for BB:93/94. The NPSAS:93 survey employed a multi-stage sample design with colleges and universities as the first-stage unit and students within schools as the second-stage unit. A total of 1,243 colleges and universities were samples for NPSAS:93 of which 88 percent participated. Each of the participating institutions supplied a list of students eligible for selection into the NPSAS:93 sample.[2]

Institutional level data come from the Integrated Postsecondary Education Data System 1993 (IPEDS) and are supplemented using data from the College Board's Annual Survey of Colleges which provides information about applications and enrollments. IPEDS is the primary postsecondary data collection program within the U.S. Department of Education and contains data on myriad institutional characteristics. In addition, the most recently available institutional

[2] For more information, see the National Center For Education Statistics' *Baccalaureate and Beyond Longitudinal Study 93/94: First Follow-up Methodology Report* (USDOE, 1996).

selectivity data were used (see Astin and Hensen (1977) for more information). This measure is a commonly used proxy for institutional quality due to its high correlation with other, more oblique, quality measures (Clark, 1983).

The sample of students used in the study is limited to students who 1) received a bachelor's degree during the period between July 1992 and June 1993 (N=10,080), 2) were working full-time, as of April 1994, earning between $1,000 and $500,000 per year (N=6,371), 3) were not enrolled in school full-time (this condition is imposed to exclude those persons who might be working in non-career occupations while primarily attending school) and who had valid GPA data (N=5,999). The student sample was additionally restricted to those students graduating with degrees in business, engineering, health, science/math, social sciences, humanities, or education from colleges with valid selectivity data (N=4,235) and having a minimum of 5 graduates included in the sample (N=3,832).[3] The sample of schools used in the proposed study is determined by students meeting the above criteria (N=328).[4]

Analyses of debt ratios required further restricting the sample to those graduates who reported indebtedness related to college costs and attending a college or university with minimum of 5 borrowers in the sample.[5] The final restricted sample of borrowers was comprised of 1,728 graduates from 209 institutions.

Variables

A variety of variables at both the individual-level and college-level were used in the study. Detailed descriptions of all variables used in this study together with descriptive statistics are shown in table 1.

Individual-level variables. Based on previous research on earnings, four types of individual-level variables are used: demographic, family background, education experience, and labor market experience. Demographic variables consisted of dummy variables capturing graduates' gender (FEMALE) and minority status (ASIAN, BLACK, and HISPANIC).

A second set of variables captures family background characteristics, which were measured using five dummy variables measuring parents' education (FIRSTGEN) and parents' occupational status (PAPROF, MAPROF, PAMANGR, PAMANGR).

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[3] The institutional level sample was limited to those schools with 5 or more graduates in the sample in order to increase the reliability of the estimated parameters.

[4] Descriptive and OLS regression comparisons of graduates in the final sample and those who were excluded due to missing data at either the individual or institutional level were conducted. These analyses yielded very similar estimates suggesting that the final sample is representative of the overall sample of graduates who were working full-time but not enrolled in college full-time.

[5] See note 3 regarding institutional sample sizes.

Table 1. Means, Standard Deviations, and Descriptions of Variables

Variable	Mean	SD	Minimum	Maximum	Variable Acronym
	I. Student Level Variables (N=3832)				
Demographic Characteristics					
Female	.55	.50	.00	1.00	FEMALE
Asian	.04	.20	.00	1.00	ASIAN
Black	.04	.19	.00	1.00	BLACK
Hispanic	.03	.17	.00	1.00	HISPANIC
Family Background					
First generation college graduate	.40	.49	.00	1.00	FIRSTGEN
Father professional	.08	.23	.00	1.00	PAPROF
Mother professional	.06	.23	.00	1.00	MAPROF
Father manager	.08	.26	.00	1.00	PAMANGR
Mother manager	.05	.23	.00	1.00	MAMANGR
Academic Background					
Cumulative College GPA	3.03	.49	1.17	4.00	GPA
Number of other schools attended	.80	.94	0	7	NUMOTHSC
Attended community college	.29	.45	.00	1.00	ATTENDCC
Business major	.17	.38	.00	1.00	BUSINESS
Education major	.19	.40	.00	1.00	EDUCATE
Engineering major	.10	.30	.00	1.00	ENGINEER
Health major	.09	.29	.00	1.00	HEALTH
Science/Math major	.12	.33	.00	1.00	SCIMATH
Humanities major	.14	.35	.00	1.00	HUMAN
Labor Market					
Job has no career potential	.24	.43	.00	1.00	NOCARPOT
No college degree required for job	.38	.48	.00	1.00	NODEGRQ
Employed in the public sector	.21	.41	.00	1.00	PUBLIC
Job is not related to major field	.25	.43	.00	1.00	JOBNOTRL
Number of job offers available	.66	1.79	0	50	OFFERS
Time elapsed since graduation	1.29	.44	.98	1.97	TIMEOUT
Hours worked per week	43.05	7.60	2.00	60.00	NUMHOURS
Tenure at current job	1.53	2.68	.00	29.94	YRSEXP
Student Outcomes					
Log annual earnings	9.96	.49	6.93	12.79	LNANSAL
Log debt to annual earnings ratio					LNDBTERN
	II. Institutional Level Variables (N=328)				
College Characteristics					
Astin's selectivity ranking	952.24	118.47	600.00	1330.00	SELECT
Undergraduate student to faculty ratio	14.39	4.74	1.60	29.96	STUFAC
Percent of undergraduate students enrolled full-time	.82	.14	.31	1.00	PCTSTUFT
Size (total undergraduates/100)	83.99	78.97	1.91	407.85	SIZE100
Urban institution	.31	.46	.00	1.00	URBAN
Private institution	.44	.50	.00	1.00	PRIVATE

Educational experiences were measured in three areas: academic performance, college mobility, and academic major. Academic performance was measured as graduates' cumulative

grade point average on a 0 – 4 point scale (GPA). Dummy variables measured college mobility – the number of times a graduate transferred between colleges before receiving the BA (NUMOTHSC) – and whether the graduate was ever enrolled in public community college prior to the BA (ATTENDCC). College majors were grouped into 6 related areas: Business, Education, Engineering, Health, Science/Math, and Humanities.

Measures of labor market experiences included a series of dummy variables capturing the relationship between a graduate's employment situation and their education. These variables indicate whether the graduate felt that his/her current position has little or no career potential (NOCARPOT), no college degree was required for his/her current position (NODEGRQ), and the relationship between the current position and the college degree field (JOBNOTRL). Another dummy variable was used to indicate the sector in which graduates were employed (PUBLIC). Continuous measures were used to capture tenure at the current position – in years – (YRSEXP), the time, in years, between receipt of the BA degree and April 1994 (TIMEOUT), the number of job offers received before taking the current position (OFFERS), and the number of hours worked per week at the current position (NUMHRS).

College-level variables. Variables were used at this level to capture a range of characteristics that might reflect perceptions of institutional quality. These included Astin's selectivity score (SELECT), which represents the average SAT scores of entering freshmen, the undergraduate student to faculty ratio (STUFAC), the percentage of undergraduate students enrolled at the institution full-time (PCTSTUFT), the size of the undergraduate student body (SIZE100), and a dummy variable indicating whether an institution was located in an urban area (URBAN) and another dummy variable indicating whether an institution was under public or private control (PRIVATE).

Descriptive Differences by Academic Major

Earnings. Full time employed college graduates differ widely in both their choice of college major and in the earnings associated with that choice. These differences, broken out by gender, are shown in table 2. Average earnings range from a high of $30,917 for health related majors to a low of $19,233 for majors in the area of education.

Consistent with previous research, women and men in this sample are unequally distributed across academic major areas (Jacobs, 1995; Polachek, 1981). While women are notably under-represented in higher earnings major areas such as business, science/math, and engineering, they are more than twice as likely as men to major in the health sciences – one of the majors yielding the highest earners. Conversely, women are almost three times as likely to major in education, the major area associated with the lowest post-graduate earnings. Substantial

disparities exist in earnings among men and women. Without exception, average earnings for females from each major area are lower than those of their male counterparts. For the entire sample, women graduates earn roughly 86 cents on the dollar relative to men. Across major areas, this differential ranges from 84 cents on the dollar for education majors to 99 cents on the dollar for engineering majors. (see Angle and Wissman, 1981; Eide, 1994; Hagedorn, Nora, and Pascarella 1996 for discussions relating to preoccupational segregation).

Debt to Earnings Ratio. Average debt levels and debt to earnings ratios are shown in table 3. Average debt levels are fairly consistent across academic major areas, ranging from a high of $12,845 for graduates of health related areas to a low of $9,458 for those graduating from education related majors.

Table 2. Mean annual earnings by major and sex[a].

Major	Males	Females	Total
Business	$27,494	$24,541	$26,124
	(17,808)	(19,852)	(18,827)
	20.54%	14.46%	
Education	$22,052	$18,448	$19,233
	(13,758)	(11,281)	(11,948)
	9.32%	26.84%	
Engineering	$30,682	$30,292	$30,627
	(9,535)	(8,994)	(9,450)
	18.93%	2.58%	
Health	$31,969	$30,545	$30,917
	(15,987)	(12,620)	(13,543)
	5.24%	12.27%	
Science/Math	$25,548	$24,258	$24,984
	(12,513)	(28,126)	(20,814)
	15.19%	9.79%	
Social Sciences	$22,925	$19,691	$21,153
	(11,064)	(10,513)	(10,878)
	18.01%	18.10%	
Humanities	$20,744	$20,387	$20,537
	(12,543)	(18,210)	(16,069)
	12.77%	14.71%	
Total sample	$25,844	$22,216	$23,862
	(13,845)	(16,660)	(15,550)
	100.00%	100.00%	

[a] Standard deviations in parentheses

Although education majors tended to borrow less money than those graduating from other major areas, they were much more likely to borrow, with over 57 percent reporting debt

related to educational costs. Moreover, this group also had the highest total debt to annual earnings ratio, .4189 (a debt ratio of 1.0 would mean that total debt equals current annual income). Contrast this with graduates from health related majors. While these graduates were just as likely to have borrowed as those from education areas, those borrowing owed 35 percent more on average ($12,845 v. $9,458). When considered in terms of their earnings however, this debt burden is 23 percent less than that shouldered by those graduating from education majors (compare debt ratios in column 4 of table 3). Such debt ratios are helpful in understanding borrowing behaviors and tolerances for graduates from the various majors. Debt ratios are commonly used in reports addressing student indebtedness. Surveys of borrowers suggest that those who have debt ratios of 1.0 and greater face a formidable financial burden that often compromises financial well being (Baum and Sanders, 1998). Aside from these debt ratios, it is also interesting to note that the proportion of students borrowing to pay for educational costs ranges from a low of 48 percent in social science fields to a high of 63 percent for those in engineering majors.

Table 3. Mean annual earnings, average debt, debt to earnings ratio, and percent borrowing by major[a].

Major	Earnings	Debt	Debt:earnings ratio (percent borrowing)
Business	$26,124	$10,824	.3117
	(18,827)	(13,960)	50.30%
Education	$19,233	$9,458	.4189
	(11,948)	(6,601)	57.26%
Engineering	$30,627	$10,675	.2535
	(9,450)	(10,007)	63.45%
Health	$30,917	$12,845	.3401
	(13,543)	(9,760)	57.47%
Science/Math	$24,984	$10,063	.3398
	(20,814)	(7,978)	56.50%
Social Sciences	$21,153	$9,481	.3824
	(10,878)	(6,621)	47.98%
Humanities	$20,537	$10,483	.4445
	(16,069)	(7,715)	53.77%
Total sample	$23,862	$10,364	.3572
	(15,550)	(9,213)	54.44%

[a] Standard deviations in parentheses

Formal Model

Modeling the effects of variables from different levels of analysis on any type of outcome presents formidable conceptual and methodological problems (Bryk and Raudenbush, 1992; Heck and Thomas, in press). Statistical techniques have recently been developed to estimate such models, which are known as multilevel or Hierarchical Linear Models (HLM). Specifically, HLM allows researchers to model individual-level outcomes within colleges and then to identify and model any between-college differences that arise. I estimated a series of models to test the effects of individual-level (graduates) and college-level predictors on earnings and debt to earnings ratios. The multilevel analyses consisted of a number of steps. First, I estimated a model with no predictor variables in order to partition the total variance in outcomes within and between colleges in the sample. This model, often referred to as the "null model" or one-way ANOVA model, appears as:

$$ln(Y_{ij}) = \beta_{j0} + r_{ij} \qquad \text{(Equation 1)}$$

where Y_{ij} is the outcome of interest for graduate *i* from college *j*, and r_{ij} is the deviation from the college mean for graduate *i*. The implied college-level model is specified as:

$$\beta_{j0} = \gamma_{00} + u_{0j} \qquad \text{(Equation 2)}$$

where β_{j0} is the college mean, γ_{00} is the grand-mean and u_{0j} is the deviation from the grand mean for college *j*. This step provides an estimate of the variance components at each level. This information is then used to determine the proportion of variance that exists within and between colleges. As we would expect, the vast majority of variance in earnings exists within colleges. Table 4 shows these variance components.

Table 4. Variance components for each outcome

	Log Earnings	Log Debt Ratio
Total Variance	.24197	.94634
Amount Within-Colleges	.22198	.84765
Amount Between-Colleges	.01999	.09869
Proportion Between Colleges	.0826	.1043

A second type of model, the individual-level or level-1 model, was then specified. This level-1 model was actually a series of models that stepped in blocks of individual-level variables that were identified as salient predictors of earnings in previous research.

$$ln(Y) = \beta_0 + \beta_{1j}(\text{DEMOGRAPHIC}) + \beta_{2j}(\text{FAMILY BACKGROUND}) + \beta_{3j}(\text{EDUCATION}) + \beta_{4j}(\text{LABOR MARKET}) + r_{ij} \qquad \text{(Equation 3)}$$

with the level-2 model appearing as,

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad \text{(Equation 4)}$$

$$\beta_{pj} = \gamma_{p0}, \; p=1, 2, 3, 4 \quad \text{(Equation 5)}$$

Equations 4 and 5 show that all individual-level coefficients except the intercept were "fixed" ($u_{pj} = 0$) so that their effects were constrained to be the same for all schools (Bryk and Raudenbush, 1992, p.55-56).[6] In addition, all individual-level variables were centered around their respective grand means so that the intercept term can be interpreted as an adjusted estimate of the outcome, or the expected value of the outcome for "average" graduates – those with mean characteristics for the entire sample (Bryk and Raudenbush, p.55-56). This is a very useful feature of HLM because it allows one to see how much of the difference in the outcomes can be attributed to differences in students, not differences in features of the colleges from which they have graduated.

The final step in this modeling process was to specify a model using college-level variables to explain the remaining between-college differences in the outcomes. This model took the form of:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} (\text{COLLEGE CHARACTERISTICS}) + u_{0j} \quad \text{(Equation 6)}$$

Variables entered at each step in this modeling process were entered sequentially, with only significant variables from the preceding step retained in the subsequent model.

RESULTS

Table 5 presents estimates of the effects the various demographic, family background, education, labor market, and college characteristics on graduates' log earnings. Table 6 presents the estimates for the graduates' log debt ratios. In both tables Model 1 gives the total effects of demographic variables (FEMALE, BLACK, and HISPANIC). Model 2 adds family background variables to the account (FIRSTGEN, PAPROF, MAPROF, PAMANGR, and MAMANGR). Model 3 adds a set of variables capturing education experiences (GPA, NUMOTHSC, ATTENDCC, BUSINESS, ENGINEER, HEALTH, SCIMATH, HUMAN) with the omitted major category being education, and Model 4 includes variables capturing labor market experiences (NOCARPOT, NODEGRQ, PUBLIC, JOBNOTRL, OFFERS, TIMEOUT, NUMHOURS, and YRSEXP). Finally, Model 5 adds a number of college-level variables (SELECT, STUFAC, PCTSTUFT, SIZE100, URBAN, PRIVATE) in an effort to account for

[6] Rumberger and Thomas (1993) found substantial variation across academic major areas in the effects of a number of factors. Accordingly, I tested the possibility the impact of academic major differs across colleges in the sample. Each of the major area parameters except HEALTH was found to be invariant across institutions.

variance remaining in the adjusted random intercepts in the student level models. The net impact of each variable is summarized in percentage terms in table 7.

Table 5. HLM log annual earnings estimates

	Model 1 *Demographic Model*	Model 2 *Background Model*	Model 3 *Education Model*	Model 4 *Labor Market Model*	Model 5 *Institutional Model*
Average Earnings	9.9582***	9.9580***	9.9593***	9.9590***	9.7733***
Institutional Level Characteristics					
Selectivity					0.0001†
Private Institution					0.0368†
UG Enrollment					0.0003**
Urban Institution					0.1879
Student Level Characteristics					
Female	-0.1595***	-0.1583***	-0.1131***	-0.0699***	-0.0680***
Father Professional		-0.0825**	-0.0646*	-0.0461†	-0.0495*
Cumulative GPA			0.0811***	0.0556***	0.0548***
Business Major			0.2632***	0.2141***	0.2087***
Engineering Major			0.4342***	0.3839***	0.3688***
Health Major			0.4424***	0.3836***	0.3772***
Science/Math Major			0.1838***	0.2027***	0.1928***
Social Science Major			0.0815***	0.1293***	0.1172***
Humanities Major			0.0029	0.0672**	0.0565*
Education Major					
No career potential				-0.1357***	-0.1358***
Degree not required				-0.1726***	-0.1687***
Public sector job				-0.0461**	-0.0419*
Job not related to major				-0.3839*	-0.0419*
Number of job offers				0.0217***	0.0220***
Time since graduation				0.0391***	0.0371***
Hours worked/week				0.0160***	0.0160***
Length of job tenure				0.0381***	0.0390***
Institutional-level Variance component	0.0185	0.0184	0.0076	0.0046	0.0040
Variance explained	0.0745	0.0795	0.6198	0.7699	0.7999
Individual-level Variance component	0.2166	0.2162	0.1986	0.1594	0.1591
Variance explained	0.0242	0.0260	0.1053	0.2819	0.2833
Reliability	0.4650	0.4630	0.2890	0.2370	0.2160

***Significant at .001 level; ** Significant at .01 level; * Significant at .05 level; † Significant at .10 level

Demographic variables. There are significant total and conditional effects of gender on both outcomes (Model 1). Male graduates enjoy higher earnings and lower debt ratios, on average. Net of all other factors in the final models, females starting salaries were 6.6% lower than those of males. Partially as a result, female debt ratios were 17.5 percent higher, on average. For both outcomes, this female penalty is diminished as other variables are controlled. This

suggests that part of the lower pay received by female graduates has to do with choice of academic major and the type of job taken after graduation. In particular, over a quarter of female graduates majored in education, the field associated with the lowest earnings.

Minority graduates had earnings and debt ratios comparable to those of their white counterparts. While at odds with recent research using a cohort of students graduating in 1985-1986 (Rumberger and Thomas, 1993), this finding is consistent with a larger body of earlier work (Gwartney and Long, 1978; Tienda and Lii, 1987; Berger, 1988; Meisenheimer, 1990).

Family background. The bulk of research examining the relationship between earnings and family background suggests that family background tends to have a greater influence on individuals' propensity to invest in higher education and the choice of the institutions in which this investment is made than on income directly (Karabel and Astin, 1975; Rumberger, 1983, Hearn, 1984). Interestingly, having a father working in a professional category is shown to have a slight negative impact on initial earnings. While greatly diminished, this effect persists across each of the earnings models, yielding a 4.8 percent penalty, on average, controlling for all other variables in the final model. The diminishing effect of this variable across models supports the notion that much of the effect of family background is indirect through educational choices. Although surprising, the negative effect of this variable is most likely due to my focus on initial salaries which may not reveal subsequent advantages that graduates from more advantaged backgrounds may enjoy.

The earnings penalty associated with having a father working in a professional category did not translate into a significant impact on the debt ratios of those who borrowed. For borrowers, however, having a mother working in a professional category yielded significantly lower debt to earnings ratios. These graduates debt to earnings ratios were almost 20 percent lower than graduates not reporting professional mothers. This effect persists in magnitude across all debt to earnings models suggesting that it is independent of experiences in college and the labor market. Moreover, the effect remains after controlling for the characteristics of colleges attended.

Educational Experiences. The results show that, net of all other variables in the models, both academic performance and choice of academic major have significant impacts on earnings and debt to earnings ratios of graduates. On average, a one point increase in cumulative GPA yields an almost 6 percent increase in earnings and, for borrowers, debt to earning ratios, that are 22 percent lower. Other studies examining the impact of GPA on earnings have generally found a positive return (Wise, 1975; James *et al.*, 1989; Jones and Jackson, 1990) although Rumberger and Thomas (1993), analyzing males and females separately, reported a positive return to females

but not to males. The results of separate analysis conducted to test for differential GPA returns based on gender (not reported here) revealed comparable returns to GPA for men and women graduates in the sample.

Table 6. HLM log debt to earning ratio estimates

	Model 1 *Demographic Model*	Model 2 *Background Model*	Model 3 *Education Model*	Model 4 *Labor Market Model*	Model 5 *Institutional Model*
Average debt ratio	-1.0193***	-1.0191***	-1.0192***	-1.0210***	-1.0718***
Institutional Level Characteristics					
Selectivity					
Private Institution					0.4509***
UG Enrollment					-0.0009**
Urban Institution					
Student Level Characteristics					
Female	0.2126***	0.2162***	0.1815***	0.1538**	0.1620***
Father Professional		0.1547	0.1530	0.1535†	0.1251
Mother Professional		-0.2089†	-0.2380*	-0.2298*	-0.2107*
Cumulative GPA			-0.2282***	-0.2199***	-0.2506***
Business Major			-0.3467***	-0.2619***	-0.2377***
Engineering Major			-0.4026***	-0.3690***	-0.3246***
Health Major			-0.2622**	-0.2411**	-0.2074*
Science/Math Major			-0.1495†	-0.1696*	-0.1993*
Social Science Major			-0.0772	-0.1765*	-0.1912**
Humanities Major			0.0837	0.0213	0.0546
Education Major					
No career potential					
Degree not required					
Public sector job					
Job not related to major				0.3025***	0.3114***
Number of job offers				-0.0269†	-0.0267†
Time since graduation				-0.1379**	-0.0402
Hours worked/week				-0.0168***	-0.0169***
Length of job tenure				-0.0809***	-0.0849***
Institutional-level					
Variance component	0.0962	0.0965	0.0960	0.0835	0.0178
Variance explained	0.0071	0.0040	0.0272	0.1539	0.8196
Individual-level					
Variance component	0.9157	0.8368	0.8063	0.7538	0.7511
Variance explained	0.0000	0.0128	0.0488	0.1107	0.1139
Reliability	0.4690	0.4700	0.4780	0.4600	0.1600

***Significant at .001 level; ** Significant at .01 level; * Significant at .05 level; † Significant at .10 level

For both outcomes, there exists a substantial difference between graduates from different academic majors, even after controlling for all other variables in the model. Relative to graduates from education majors, health majors, on average, enjoy a 46 percent earnings advantage. Engineering majors also enjoy substantial earnings advantages amounting to 46 percent more

than comparable graduates from education majors. Business and science/math graduates earn 21 to 23 percent more than education graduates in the sample while majors in the social sciences earn just over 12 percent more, on average. Graduates from humanities also report higher earnings relative to those from education although their advantage, just under 6 percent, is much smaller than those enjoyed by graduates from other fields. Similar patterns have been observed in a number of other studies (Griffen and Alexander, 1978; Rumberger, 1984; Berger, 1988a; James *et al.*, 1989; and Rumberger and Thomas, 1993). Consistent with Rumberger and Thomas (1993), in most cases, the direct effects of major were diminished by the introduction of variables capturing labor market experiences. This suggests that the various college majors continue access to different labor markets, which influences earnings.

Table 7. Summary of variable impact in percentages (per 1 unit increase in X)

	Model 5 *Earnings*	Model 5 *Debt Ratios*
Institutional Level Characteristics		
Selectivity	0.01%	
Private Institution	3.75%	56.97%
UG Enrollment	0.03%	-0.09%
Urban Institution	20.67%	
Student Level Characteristics		
Female	-6.57%	17.59%
Father Professional	-4.83%	13.33%
Mother Professional		-19.00%
Cumulative GPA	5.63%	-22.17%
Business Major	23.21%	-21.16%
Engineering Major	44.60%	-27.72%
Health Major	45.82%	-18.73%
Science/Math Major	21.26%	-18.07%
Social Science Major	12.43%	-17.40%
Humanities Major	5.81%	5.61%
Education Major		
No career potential	-12.70%	
Degree not required	-15.52%	
Public sector job	-4.10%	
Job not related to major	-4.10%	36.53%
Number of job offers	2.22%	-2.63%
Time since graduation	3.78%	-3.94%
Hours worked/week	1.61%	-1.68%
Length of job tenure	3.98%	-8.14%

Likewise, disparities in existed in debt ratios among borrowers. Graduates from majors in education and the humanities have the highest debt ratios. It is not coincidental that graduates from these majors also report the lowest earnings. Beyond these traditionally low earning majors,

important differences emerge. For example, while health and engineering majors enjoyed comparable earnings advantages, graduates from health related majors borrowed significantly more than engineering graduates did. Graduates from health related majors, the highest paying major area, experienced debt ratios 19 percent lower than those from education and the humanities. Engineers, however, had the lowest debt ratios, roughly 9 percent lower than graduates from health related majors. In fact, although graduates from health majors earned more, they were near the top in terms of their debt ratios.

Labor Market Experiences. A number of labor market variables show significant influences on the starting salaries and debt ratios of graduates. Controlling for all other variables in the model, graduates who have been out of college longer, received a greater number of job offers, worked at their current job longer, and worked more hours each week enjoy a significant wage premium. Conversely, those graduates working in jobs unrelated to their college major, in jobs with little career potential, in jobs where a college degree is not required, or in a job in the public sector, suffer a significant earnings penalty.

Among these labor market variables, the greatest earnings advantage is associated with the number of hours worked each week, where, on average, a one standard deviation increase in hours worked yields a 13 percent advantage in earnings. Another strong earnings determinant is the length of graduates' job tenure, a one standard deviation increase in tenure is associated with an 11 percent earnings advantage, net of all other variables in the final model. The greatest earnings disadvantages were associated with working in a job where a degree is not required. Graduates in such positions experienced an almost 16 percent penalty. Graduates working in positions with no career potential experienced another significant earnings penalty, almost 13 percent. Finally, earnings penalties of just over 4 percent were associated with both working in the public sector and with working in a job unrelated to one's college major.

While, for the full sample, working in a job unrelated to one's major had a small but significant impact on earnings, it has a substantial affect on the debt ratios of borrowers. Those graduates finding themselves in such a position, on average, experience debt ratios 37 percent larger, controlling for all other variables in the model. Other variables that had a negative impact among all earners failed to significantly affect debt ratios. Of the other labor market variables having a meaningful positive impact, length of job tenure was the most important, associated with debt ratios 8 percent lower for each year of tenure, on average. It should be noted that the average tenure on the job was 1.53 years. This suggests that many graduates started their jobs before completing the requirements for their degrees. The large impact of time on the job is most likely

due to the ability of these graduates to meaningfully supplement funds required to pay for college expenses.

Institutional characteristics. Earnings and debt ratios are significantly impacted by a number of institutional characteristics. Institutional size, sector, and quality as measured by Astin and Henson's selectivity score, all had slight positive impacts on earnings. Holding all student characteristics constant, graduates from private institutions enjoy a slight 4 percent earnings advantage over public college graduates. Moreover, graduates from colleges with selectivity scores 100 points higher than comparison colleges experienced a 1 percent earnings premium, on average. This premium is smaller than those reported in recent studies (Wales, 1973; Wise, 1975; James *et al.*, 1989; Rumberger and Thomas, 1993) and may point to a hypothesized uncoupling of the college degree and wage attainment (Pryer and Schaffer, 1997). Earlier work also points to differential returns to college quality based on one's family background. Karabel and McClelland (1987) reported higher premiums for graduates from families with professional and managerial backgrounds than for graduates from blue-collar backgrounds.

While graduating from a private college was found to yield a slight earnings advantage (4%), borrowers from these institutions had debt ratios 57 percent higher than their peers from public institutions. Borrowers from larger institutions had slightly lower debt ratios on average. A size difference of 100 students was associated with an almost 1 percent decrease in debt ratios of graduates from those larger institutions. This very small debt ratio advantage is similar to a very small earnings advantage enjoyed by graduates from larger colleges (see table 7).

Variance Explained by the Models. The bottom portion of tables 5 and 6 summarize the variance explained at each level by each of the models. For both outcomes, the final models explain roughly 80 percent of the variance between colleges. At the individual level, the final models explained 28 percent of the variance in earnings and 11 percent of the variance in debt ratios. Individual level characteristics (i.e. demographic, background. education, and labor market variables) importantly diminished the initial variance in earnings observed between colleges.

The estimated variance components for earnings Model 4 show that almost 77 percent of the variance in earnings between colleges is explained by these individual-level factors. After controlling for these factors, little variance in earnings exists between colleges. The addition of institutional-level variables explains roughly 13 percent of the slight variance in earnings remaining between colleges. This demonstrates that while over three-quarters of the variance in earnings between colleges is attributable to the students within those colleges rather than features of the colleges themselves, institutional factors such as those used here are still helpful in explaining variance found at the college level.

A very different picture emerges when debt ratios are considered. Although, similar to earnings variance, most of the variance in debt ratios exists within schools, the variance components for these models (Table 5) suggest that college factors included in the model are the biggest determinants of these between college differences (explaining 78 percent of the adjusted variance). Not surprisingly, the biggest explanatory factor is college control. Very simply, graduates of private colleges borrow significantly higher amounts to pay for their educational expenses. This is directly translated into the debt ratio models shown in table 6.

SUMMARY AND CONCLUSIONS

This study investigated three sources of influence on the initial earnings of college graduates and on the debt ratios of those graduates borrowing money to finance their educational costs. Each of these factors has been shown in previous research to influence initial earnings but no research to date has explored their systematic impact on indebtedness or the ways in which indebtedness and initial earnings are linked. The present study addressed many of the limitations of previous research. The data used in this study provided information on the earnings and debt ratios of recent, 1992-1993 college graduates. Following from Rumberger and Thomas (1993) it also included information on all three of the factors of interest; it included minorities and women as well as men in the sample, and employed HLM modeling techniques to more appropriately demonstrate the net impacts of institutional-level measures.

The results confirmed the importance of all three qualitative factors on earnings and revealed their mixed effects on debt ratios of recent graduates. College major had an important impact on both earnings and debt ratios although this impact varied. Graduates from health related and engineering majors commanded the highest relative salaries. Graduates with the lowest earnings were those from majors in education and humanities. College performance, as measured by grade point average (GPA), was shown to have a positive impact on earnings and a negative impact on debt ratios. College quality also affected the initial earnings of graduates but at much lower levels than previously reported. Quality, at least as measured by selectivity, had no discernible impact on debt ratios. Females continue to suffer a significant penalty in terms of earnings and debt ratios. It is also notable that no race-based differences in either outcome were identified.

While confirming the continued existence of relationships demonstrated in previous research on earnings, an important contribution of this study is the contextualizing of these relationships in a broader framework of indebtedness. Previous studies have only been able to identify the factors associated with earnings, with no systematic connection to the risks and sacrifices graduates have made to complete a course of study that facilitate careers in particular

occupations. Well over one-half of the students in the sample reported borrowing money to finance their investment in higher education. The average debt load of these borrowers was over $10,000 yielding an average debt ratio of .36. The results of this study demonstrate that graduates from some academic majors tend to command salaries considerably higher than those earned by graduates from other academic majors. More importantly though, the results further show that those who financed their college education in some of these higher paying areas also tend to be the most heavily indebted as a result of their studies. This demonstrates the importance of better contextualizing research examining the economic outcomes associated with college attendance.

The well reported returns to college quality have also been put into better perspective. The results of this study suggest that while attending more selective institutions yields a very slight net increase in earnings, there is no impact on the debt ratios of those students financing such an investment. Interestingly, the attenuated effect of college quality observed in this study occurs at a time when graduates were faced with a highly uncertain labor market (Northwestern Lindquist-Endicott Report, 1993). It is precisely during such periods that employers might be better positioned to first hire graduates from more prestigious schools. This trend was not conspicuously evident among the recent graduates in this sample. Its absence calls attention to recent research hypothesizing a diminished "sheepskin" effect resulting from employers' search for students with basic literacy skills regardless of their academic pedigree (Pryer and Schaffer, 1997).

While educational investments in private colleges were shown to have a small positive impact on earnings (4 percent) these investments were also the costliest for borrowers. Just over half of all graduates from public colleges reported borrowing money to pay for educational expenses. Graduates from private colleges were not only more likely to report borrowing (60 percent) but they also borrowed significantly more. Among borrowers, those graduating from private institutions experienced debt ratios 57 percent greater than their counterparts from public colleges. Such a small return in terms of initial salaries is therefore washed out by the associated debt burden. Other research on earnings, however, (Fox, 1993) suggests important interactions between private control and quality. This is an area that demands more research in terms of long term earning trajectories of graduates from various types of institutions.

Future research should be directed at developing an understanding of interactions that may exist between academic major area and the various salient predictors in the models. For example, earlier work by Rumberger and Thomas (1993) was able to demonstrate a number of important gender and race based differences in many of the majors they analyzed. Data requirements prohibited a replication of their work in which separate models were run for each

major area. Some of the interactions that emerged in that earlier work should be tested using data from the B&B:93/94 sample. Moreover, future work should also more fully explore such interactions in the context of undergraduate debt burden.

Perhaps most importantly, however, B&B:93/94 provides the research community with an important opportunity to examine these outcomes not only in terms of initial post-graduate earnings but also in terms of future earnings. Subsequent waves of this survey will allow for the examination of various factors that are presumed to impact future earnings and salary growth as well developing a better sense of the ways in which indebtedness relates to these outcomes over time.

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