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LABOR MARKET RETURNS TO TWO- AND FOUR-YEAR COLLEGES: IS A CREDIT A CREDIT AND DO DEGREES MATTER?

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ABSTRACT

In CPS data, the 20% of the civilian labor force with 1-3 years of college earn 15% more than high school graduates. We use data from the *National Longitudinal Study of the High School Class of 1972* which includes postsecondary transcript data and the *NLSY* to study the distinct returns to 2-year and 4-year college attendance and degree completion. Controlling for background and measured ability, wage differentials for both 2-year and 4-year college credits are positive and similar. We find that the average 2-year and 4-year college student earned roughly 5% more than high school graduates for every year of credits completed. Second, average bachelor and associate degree recipients did not earn significantly more than those with similar numbers of college credits and no degree, suggesting that the credentialling effects of these degrees are small. We report similar results from the NLSY and the CPS.

We also pursue two IV strategies to identify measurement error and selection bias. First, we use self-reported education as an instrument for transcript reported education. Second, we use public tuition and distance from the closest 2-year and 4-year colleges as instruments, which we take as orthogonal to schooling measurement error and other unobserved characteristics of college students. We find that in our data the two biases roughly cancel each other, suggesting that the results above are, if anything, understated.

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I. Introduction

In Current Population Survey data, the 20% of the labor force with 1-3 years of college earned 15% more than high school graduates during the mid-Eighties.[1] While it is tempting to think of those with "some college" as primarily four-year college drop-outs, no more than 40% of them attended only a four-year college. Rather, 15% have associate's degrees, and approximately 60% attended a two-year college at some time.[2] Given that twenty percent of federal Pell Grants, 10% of Guaranteed Student Loans (GSL) and over 20% of state post-secondary education expenditures go to community colleges,[3] the lack of knowledge regarding community college wage differentials is a particularly regrettable gap in the empirical literature.

The lack of data has been the primary obstacle. For 50 years since the decennial census of 1940, the Bureau of the Census has collected data on years of school completed, with no questions to distinguish former 2-year and 4-year college students and degree recipients. We attempt to fill this gap by employing two

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[1] The labor force estimate is from *Statistical Abstract of the United States 1991*, Table 634, and the earnings differential from Murphy and Welch (1989), p. 21.

[2] Authors' calculations using the *National Longitudinal Survey of the High School Class of 1972*.

In *The American Junior College*, Cohen and Brawer define the junior college as, "...any institution accredited to award the associate's in arts or science as its highest degree." (pp. 5-6) This definition includes comprehensive two-year colleges, community colleges and it excludes publicly funded vocational schools, adult education centers, and most proprietary schools. We will use the terms junior college, community college, and two-year college interchangeably.

[3] We draw the estimate of the proportion of Pell and GSL money spent at community colleges from the National Center for Education Statistics, *Undergraduate Financing of Post-secondary Education* (1988), pp. 48-49. Halstead (1989) estimates that the cost of a full-time equivalent enrollment (FTE) at a community college is roughly 70% of the average. Since community college students represent 30% of FTE enrollment nationwide, we estimate that roughly 21% of state and local post-secondary education subsidies flow to community colleges.

different data-sets which allow one to make the distinction between 2-year and 4-year college attendance. Using the 1986 follow-up of the *National Longitudinal Study of the High School Class of 1972* (NLS-72) and the *National Longitudinal Survey of Youth* (NLSY), we find that the average person who attended a two-year college earned about 10% more than those without any college education, even without completing an associate's degree. Contrary to the widespread skepticism regarding the value of a community college education, the estimated returns to a credit at a 2-year or 4-year college are both positive and remarkably similar: roughly 5% for every 30 (two semesters) completed credits. Further, the certification value of a degree appears to be small relative to the value of the coursework. Except for limited evidence of the value of an associate's degree for women and a bachelor's degree for men, the average associate's and bachelor's degree-holders earned no more than those with similar amounts of 2-year or 4-year college credits. Both results are conistent with the linear relationship between years of "college" and earnings observed in Census data and in the February 1990 *Current Population Survey* which contains data on years of school and degrees completed. We estimate similar differentials using either hourly wages, annual earnings, or measures of occupational prestige, the latter being highly correlated with permanent income.[4] Although community college students from the high school class of 1972 may have entered institutions quite different from those today, we find similar results for more recent cohorts in the NLSY, which graduated from high school between 1976 and 1983.

There are two primary empirical challenges in estimating educational wage differentials: controlling for selection bias and adjusting for measurement error in the

[4] Crane (1992) has shown that the correlation between occupational status and a 9-year average of annual income was .74. We also ran these regressions with Duncan scores generating similar results.

schooling variable. Although selection bias has received considerably more attention, Ashenfelter and Krueger (1992) have rekindled a concern about measurement error in their work with twins, using alternative measures of schooling as instrumental variables. We adopt an estimation strategy that would allow us to identify these separate sources of bias. To address the selection bias problem, we first controlled for a battery of standardized test scores, high school class rank, and family income-- the combination of which yields estimated educational wage differentials as much as 25% less than what would have been found otherwise, suggesting substantial ability/backgound bias. We then used self-reported education as an instrument for our measure of schooling from the transcripts. Continuing to use the family background and ability measures to control for selection, instrumenting with self-reported education yields estimates roughly equal to OLS estimates one finds before conditioning upon background and ability.

However, we certainly may not have controlled for all of the unobserved differences between 4-year college students, community college entrants and other high school graduates with the family background and ability measures provided with the data. College students of either type may simply be "more motivated" than other high school graduates. As a result, we pursued a second IV strategy using public tuition by state as well as proximity to the closest two-year or four-year college as instruments which we hypothesize are orthogonal to both unmeasured determinants of wages as well as transcript measurement error. Again, our IV results suggest that the original OLS estimates of an 8-9% differential in annual earnings would not be rejected.

Both results-- small credentialling effects and the similarity of wage differentials for 2-year and 4-year college credits-- may be taken as supportive of the human capital model. First, if coursework is more difficult for employers to observe than degrees completed, one might have expected the value of the degree signal to

have been large under a signalling story. Further, although tuitions are generally lower at 2-year colleges than at 4-year colleges, the opportunity costs of college enrollment-- which represent the bulk of college costs-- are probably similar at both. One might have expected students to have enrolled in either type of college until the relative returns were similar.

In the next section of the chapter, we describe the data and our empirical strategy. In the third section, we present the OLS results. The fourth section contains estimates of the measurement error and the instrumental variables estimates. Section five concludes.

II. Data and Empirical Strategy

The National Longitudinal Survey of the High School Class of 1972

The *National Longitudinal Survey of the High School Class of 1972* (NLS-72) is a longitudinal survey that originally sampled 22,652 seniors from the high school class of 1972. The respondents were surveyed in the spring of 1972, fall 1973, fall 1974, fall 1976, fall 1979, and winter 1986; the 1986 wave represents a subsample of roughly 60% of the original students.[5] In 1984, transcripts were requested from all of the schools survey participants had reported attending in the first four follow-ups. The *Post-secondary Education Transcript Survey*, known as PETS, contains roughly 19,000 transcripts on about 14,000 sample members.[6] The transcripts contain information on all post-secondary schools reported by the students through 1979 and include course credits by field, grades and any degrees obtained.[7] The survey enjoyed a 94% response rate from four-year schools and a 91% response rate from two-year schools. Because the response rate for proprietary vocational schools was much lower, 43%, we are more cautious in interpreting those results.[8]

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[5] In the 1986 wave, Hispanics, teachers or "potential teachers" (education majors, those certified to teach or who expected to become teachers, and those with a background in the sciences, mathematics, or engineering), those with a BA or an advanced degree, those who were divorced, widowed or separated from their spouses, never-married parents, and those with small initial selection probabilities were sampled with certainty. Those who did not participate in the 1979 wave were less likely to be retained. Though we present only the unweighted OLS results, weighting had little impact on our estimates.

[6] Clifford Adelman of the Department of Education was responsible for cleaning the transcript data used in this paper.

[7] Note that if respondents failed to report all post-secondary institutions attended through 1979 PETS will under-estimate their educational attainment and so probably understate educational wage differentials.

[8] Jones, *et al.*, p. 10.

We used several criteria in creating the sample. First, we limited the analysis to those who were working and not self-employed in 1986.[9] Second, since we sought a measure of actual work experience, we only included those sample members who participated in all five follow-ups of the survey. Another 2467 participants were missing information on standardized test scores and 468 participants reported extremely high or low wages.[10] We excluded an additional 682 individuals for whom any transcript data was missing because their schools did not return the information or because the schools could not be found. There were 626 others who reported periods of enrollment for which the schools had no record, i.e. the schools responded but reported that such a student had not attended. We did not exclude this last group, but included a dummy variable to test whether these "liars" had average

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[9] Actually, the wage data were drawn for one's current or most recent job between 1979 and 1986. Approximately three-quarters of the wages are from 1986, although we converted all wages into 1986 dollars. Our results are robust to the exclusion of the self-employed. The annual earnings are the average of reported earnings in 1984 and 1985. Those with zero earnings in either year were excluded.

[10]The wage data in the fifth wave of the NLS-72 is based upon 3 questions. The first asks respondents to report their "salary" on their current or most recent job. The second prompts respondents to indicate whether what they have reported is an hourly, weekly, bi-weekly monthly or yearly wage. The third question asks about how many hours the person worked in an average week at that job. The resultant NLS-72 wage distribution has much longer tails than that found in the CPS. For instance, though the median wages of those with 1-3 years of college are similar in the CPS when compared to the NLS-72-- $9.08 versus $9.85 respectively-- the means are dramatically different-- $9.00 versus $589.00 respectively. One hypothesis to explain the "thick tails" in the NLS-72 is greater reporting error introduced by the use of an open-ended salary period. In responding to the first question, some hourly workers may have recorded their annual, monthly or weekly earnings and then correctly indicated that they are paid by the hour. Similarly, others may have recorded their hourly wage in the first field and then correctly reported that they are paid on a bi-weekly basis. The first of these would lead to large positive errors in the estimates of hourly wages; the second, obviously, would lead to gross underestimates. By leaving the salary period for the first question open-ended, the structure of the questioning seems to lend itself to greater reporting error. As a result, we trimmed those with reported hourly wages less than $1.67 (half the minimum wage at the time) and above $60 (roughly the 98th percentile). The annual earnings and prestige score data had many fewer outliers. In working with annual earnings, we only excluded those who reported zero earnings in 1984 or 1985 and those with average annual earnings less than $1000.

wages different from those other high school graduates.[11] In fact, they did not.

The National Longitudinal Survey of Youth

The *National Longitudinal Survey of Youth* (NLSY) consists of 12,686 14-21 year olds in 1979, who have been surveyed every year since 1979, and most recently in 1990. In 1990, 82% of the original respondents were sampled. We ignored members of the special military subsample (1269 observations), those who had not participated in all waves of the survey (2658 people), and those who were enrolled in school in 1990 (581 people).[12] While the NLS-72 has more complete schooling information, the NLSY has the advantage of following more recent cohorts and containing better labor force information.[13] The measure of ability reported in the survey is the military's ASVAB test of skills which were administered to all of the respondents in 1979. From these tests we constructed an AFQT score.[14] Because participants were of different ages in 1979, we adjust the score for age by regressing the raw score on age dummies and using the residual.

In constructing the NLSY sample, we imitated our NLS-72 sample to the extent possible. Thus, our sample consists of high school graduates who were

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[11] See Appendix Ia for sample means and standard deviations.

[12] We got similar results selecting individuals whose primary activity had been working for the past two years and those who had not been enrolled in the past year, and not selecting based on either schooling or work.

[13]However, the survey has less complete information on family socio-economic status while the respondents were dependents. For example, "total family income" partially represents the contributions of those respondents over the age of 18. As a result, we rely more heavily on the ability tests in the NLSY than in the NLS-72.

[14] The AFQT is a linear combination of the arithmetic reasoning, word knowledge, paragraph completion, and numerical operation tests.

working and not self-employed in 1990.[15] We excluded those with hourly wages below $1.67 (half the minimum wage until April 1, 1990) or over $72 in current dollars.[16] To construct a measure of actual experience, we used total weeks worked in each year since 1975.[17] If a respondent missed one survey, we imputed weeks worked only if she had worked in the preceeding and proceeding years.[18] Finally, 87 people either reported attending college or having completed 13 or more years of schooling, but did not identify a college type. We include a dummy variable to identify them.[19]

Empirical Strategy

The results reported here improve on previous research on college wage differentials in several ways. First, with the NLS-72 data, actual post-secondary school transcripts are used to measure the number and type of courses taken as well as degrees obtained, thereby minimizing the measurement error in the schooling variable.[20] Second, we evaluate wage, annual earnings and occupational prestige differentials 14 years after high school graduation in the NLS-72 and 6 to 13 years after high school in the NLSY, allowing sufficient time to observe the returns to

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[15] About 5% of the sample was self-employed (636 persons), although our results are not sensitive to their exclusion.

[16] Seventy-two dollars in 1990 is equivalent to $60 in 1986, the wage criterion we used in the NLS-72.

[17] Using total hours worked since 1978 yielded similar results.

[18] The effect of our imputation is to mainly decrease standard errors with little effect on coefficients.

[19] See Appendix Ib for sample means and standard deviations.

[20] Ashenfelter and Krueger (1992) suggest that there may be substantial downward bias in estimated returns to schooling due to measurement error.

different types of human capital investment. Third, as others working with earlier waves of the NLS-72 have done, we attempt to control for family background and ability by controlling explicitly for parental family income, high school class rank and a battery of test scores measured at the time of the base-year survey. Further, because we were worried about measurement error in schooling introduced by the lack of comparability between credits at different schools, we then pursue an IV strategy using self-reported education as an instrument for transcript-reported education. Finally, we attempted to control for vestiges of ability/background effects or measurement error by using variation in two-year and four-year college proximity, and 2-year and 4-year public tuition levels as a natural experiment generating an instrumental variables (IV) estimator.

III. OLS Regression Results

We begin by developing a baseline for comparing our data with estimates from the Current Population Survey (CPS), replicating the typical log-wage specification (using log hourly wages) controlling for region, experience, and race, but not using family background and ability controls. These results, for both men and women, estimated from both the NLS-72 and NLSY, are reported in Table 1.[21]

Table 1

Coefficient on Years of Schooling from Log-wage Equation
using NLS-72 and NLSY

	Men		Women	
	NLS-72	NLSY	NLS-72	NLSY
Years of School	0.070	0.080	0.073	0.093
	(0.005)	(0.005)	(0.005)	(0.005)

In the 1986 CPS, the estimated wage differential per year of schooling for 25-35 year-olds was 9.6% for men and 10.7% for women.[22] The estimated wage

[21]For the NLS-72, years of education were estimated from the transcript data. Those with associate, bachelor, master and PhD or MD degrees were assigned 14, 16, 18 and 20 years of schooling respectively. For those without degrees, years of schooling were determined by the number of credits actually completed, using the rule of thumb of 30 credits per year as suggested in the Current Population Survey interviewer's manual.

[22] The NLS-72 estimates use actual (i.e. from transcripts) years of schooling completed in any school entered before 1979 and the NLSY estimates refer to self-reported years of schooling. Both data sets use measures of actual rather than potential experience (age-years

differential was roughly 7% in the NLS-72 and 8-9 % in the NLSY, before conditioning upon family background and ability. Therefore, the educational differentials reported here are roughly consistent with estimates from the CPS.

Estimated Returns to Credits and Degrees Completed in the NLS-72

Tables 2a and 2b report OLS estimates of wage, annual earnings, and occupational prestige differentials associated with credits completed and degrees received at 2-year or 4-year colleges between 1972 and the end of 1979.[23] (Credits earned or degrees received at vocational schools were not counted).[24] To convert

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of education-6). The CPS estimates derive from the annual merge file of the out-going rotation groups. The sample included full-time, non self-employed workers aged 25-35 who earned at least 1/2 of the minimum wage in the relevant year. Top-coded earnings were multiplied by 1.45.

[23] A credit at a school on the quarter system was considered at 2/3 the weight of a semester credit, using a rule of thumb suggested by the Association of Independent Colleges and Universities. In addition, students were given 2 credits for courses for which no number of credit hours was recorded but had passing grades (2% of all college courses) and 2 credits for courses with neither credits nor grades (.42% of college courses). Failed courses or courses with alpha-numeric course grades indicating "Incomplete," "Withdrawn" or "Unsatisfactory" were not counted in the total credits. Courses accompanied by credits but no grades were counted as having been passed (1.5% of all courses). The maximum number of credits allowed per course was 12 (.2% of 2-year and 4-year college courses had more than 12 credits indicated). Transfer courses were not double-counted. In addition, we included dummies for 3 different categories of degrees: The first is for degrees completed and recorded on an official transcript before 1980 (these coefficients are reported in Table 2). The second includes degrees completed after 1980 and reported on the official transcripts collected in 1984. However, since the transcripts were collected only from those schools reportedly entered before 1979, not all of those with degrees actually completed between 1979 and 1984 would have been included in this group. As a result, a third category includes self-reported degrees between 1979 and 1986 reported in the fifth follow-up. Those with multiple degrees were classified by their highest degree.

[24] Given the very low response rates of the vocational schools and widely varying methods for assigning credits for courses completed, here we ignored vocational school education. Therefore, the estimates using numbers of credits should be understood as estimating the difference between college students and high school graduates who may also have attended

TABLE 2a

RETURNS TO COLLEGE CREDITS, MALES: OLS RESULTS, NLS-72

Dependent Variable: Log Hourly Wage

	Total College Credits/30		Credits by Type of College/30	
Independent Variables	(1)	(2)	(3)	(4)
Total Number of College Credits (Two- and Four-year College)/30	0.0671 (0.0048)	0.0493 (0.0057)		
Total Number of Two-year College Credits/30			0.0510 (0.0119)	0.0492 (0.0139)
Total Number of Four-year College Credits/30			0.0491 (0.0058)	0.0159 (0.0105)
AA (Highest Degree)				-0.1118 (0.0548)
BA (Highest Degree)				0.1581 (0.0442)
Graduate Degree (Highest Degree)				0.2409 (0.0707)
Hypothesis Testing (p-values):				
2-Year Credit = 4-Year Credit			0.8695	0.0153
AA = BA = Graduate Degree = 0				0.0000
Includes Ability/Family Background?	no	yes	yes	yes
R^2	0.1443	0.1627	0.1627	0.1785

Dependent Variable: Log Annual Earnings

	Total College Credits/30		Credits by Type of College/30	
Independent Variables	(1)	(2)	(3)	(4)
Total Number of College Credits (Two- and Four-year College)/30	0.0849 (0.0054)	0.0674 (0.0063)		
Total Number of Two-year College Credits/30			0.0635 (0.0132)	0.0707 (0.0153)
Total Number of Four-year College Credits/30			0.0679 (0.0064)	0.0552 (0.0117)
AA (Highest Degree)				-0.0997 (0.0605)
BA (Highest Degree)				0.0574 (0.0491)
Graduate Degree (Highest Degree)				0.1132 (0.0799)
Hypothesis Testing (p-values):				
2-Year Credit = 4-Year Credit			0.7329	0.3094
AA = BA = Graduate Degree = 0				0.0952
Includes Ability/Family Background?	no	yes	yes	yes
R^2	0.1666	0.1906	0.1907	0.1952

NOTE: Also included in all regressions are an intercept, race, parent's income, percentage rank in high school, NLS-72 test score, years of actual experience, years with children less than six years old, the size of the respondent's city in 1973, dummies for part-time employment and for the region of the respondent's high school, and education dummies for self-reported education begun after 1979. The excluded group from the race dummies is White-non-Hispanic. There are 2262 observations in the hourly wage equations and 2477 in the annual earnings equations.

TABLE 2a (Continued)
RETURNS TO COLLEGE CREDITS, MALES: OLS RESULTS
NLS-72

Dependent Variable: Log Occupational Prestige

	Total College Credits/30		Credits by Type of College/30	
Independent Variables	(1)	(2)	(3)	(4)
Total Number of College Credits (Two- and Four-year College)/30	0.0686 (0.0032)	0.0531 (0.0037)		
Total Number of Two-year College Credits/30			0.0433 (0.0078)	0.0329 (0.0091)
Total Number of Two-year College Credits/30			0.0542 (0.0038)	0.0339 (0.0070)
AA (Highest Degree)				-0.0034 (0.0358)
BA (Highest Degree)				0.0821 (0.0293)
Graduate Degree (Highest Degree)				0.1573 (0.0476)
Hypothesis Testing (p-values):				
2-Year Credit = 4-Year Credit			0.1540	0.9154
AA=BA=Graduate Degree=0				0.0067
Includes Ability/Family Background?	no	yes	yes	yes
R^2	0.2608	0.2822	0.2828	0.2978

NOTE: Also included in all regressions are an intercept, race, parent's income, percentage rank in high school, NLS-72 test score, years of actual experience, years with children less than six years old, the size of the respondent's city in 1973, dummies for part-time employment and for the region of the respondent's high school, and education dummies for self-reported education begun after 1979. The excluded group from the race dummies is White-non-Hispanic. There are 2262 observations in the hourly wage equations and 2408 in the annual earnings equations and 2624 in the occupational prestige equations.

TABLE 2b

RETURNS TO COLLEGE CREDITS, FEMALES: OLS RESULTS, NLS-72

Dependent Variable: Log Hourly Wage

Independent Variables	Total College Credits/30		Credits by Type of College/30	
	(1)	(2)	(3)	(4)
Total Number of College Credits (Two- and Four-year College)/30	0.0701 (0.0046)	0.0501 (0.0051)		
Total Number of Two-year College Credits/30			0.0619 (0.0114)	0.0435 (0.0139)
Total Number of Four-year College Credits/30			0.0488 (0.0052)	0.0366 (0.0111)
AA (Highest Degree)				0.0847 (0.0471)
BA (Highest Degree)				0.0531 (0.0460)
Graduate Degree (Highest Degree)				0.1204 (0.0699)
Hypothesis Testing (p-values):				
2-Year Credit = 4-Year Credit			0.2478	0.6055
AA, BA, Graduate Degree=0				0.1618
Includes Ability/Family Background?	no	yes	yes	yes
R^2	0.2763	0.3031	0.3035	0.3096

Dependent Variable: Log Annual Earnings

Independent Variables	Total College Credits/30		Credits by Type of College/30	
	(1)	(2)	(3)	(4)
Total Number of College Credits (Two- and Four-year College)/30	0.0747 (0.007)	0.0571 (0.0074)		
Total Number of Two-year College Credits/30			0.0559 (0.0167)	0.0289 (0.0205)
Total Number of Four-year College Credits/30			0.0572 (0.0076)	0.0392 (0.0165)
AA (Highest Degree)				0.1517 (0.0702)
BA (Highest Degree)				0.0811 (0.0391)
Graduate Degree (Highest Degree)				0.1748 (0.1045)
Hypothesis Testing (p-values):				
2-Year Credit = 4-Year Credit			0.9367	0.6028
AA, BA and Graduate Degree=0				0.1016
Includes Ability/Family Background?	no	yes	yes	yes
R^2	0.3072	0.3197	0.3197	0.3225

NOTE: Also included in all regressions are an intercept, race, parent's income, percentage rank in high school, NLS-72 test score, years of actual experience, years with children less than six years old, the size of the respondent's city in 1973, dummies for part-time employment and for the region of the respondent's high school, and education dummies for self-reported education begun after 1979. The excluded group from the race dummies is White-non-Hispanic. There are 2408 observations in the hourly wage equations and 2178 in the annual earnings equations.

TABLE 2b (Continued)
RETURNS TO COLLEGE CREDITS, FEMALES: OLS RESULTS
NLS-72

Dependent Variable: Log Occupational Prestige

	Total College Credits/30		Credits by Type of College/30	
Independent Variables	(1)	(2)	(3)	(4)
Total Number of College Credits (Two- and Four-year College)/30	0.0441 (0.0029)	0.0303 (0.0032)		
Total Number of Two-year College Credits/30			0.0496 (0.0073)	0.0350 (0.0090)
Total Number of Four-year College Credits/30			0.0282 (0.0033)	0.0245 (0.0072)
AA (Highest Degree)				0.0796 (0.0299)
BA (Highest Degree)				0.0152 (0.0302)
Graduate Degree (Highest Degree)				0.0409 (0.0464)
Hypothesis Testing (p-values):				
2-Year Credit = 4-Year Credit			0.0037	0.2285
AA, BA, Graduate Degree=0				0.0492
Includes Ability/Family Background?	no	yes	yes	yes
R^2	0.2121	0.2401	0.2424	0.2518

NOTE: Also included in all regressions are an intercept, race, parent's income, percentage rank in high school, NLS-72 test score, years of actual experience, years with children less than six years old, the size of the respondent's city in 1973, dummies for part-time employment and for the region of the respondent's high school, and education dummies for self-reported education begun after 1979. The excluded group from the race dummies is White-non-Hispanic. There are 2352 observations in the hourly wage equations, 2408 in the annual earnings equations and 2814 in the occupational prestige equations.

credit counts into units comparable to a year of schooling, we divide the total number of credits by 30, the rule of thumb suggested in the CPS Interviewer's manual for a year of college credit. For both men and women, the first column suggests a 6-8% wage, annual earnings or occupational prestige differential for every 30 credits of college credit completed. This was true before conditioning upon family background or ability.

However, as summarized in Table 3, two-year and four-year college students are quite different from high school graduates and from each other:

Table 3

Characteristics by First Post-secondary Activity in the NLS-72

(Unweighted)

Characteristic	Post-secondary Activity			
	No Postsecondary Schooling	Attended Two-year College Only	Attended Both Two- and Four-year College	Attended Four-year College Only
Parent's Income ($1990)	27,184	31,077	34,254	35,686
% High School Rank	43	50	64	71
Standardized Test Score (Mean=0, S.D.=1)	-0.56	-0.19	0.28	0.55

Note: The cells represent averages conditional on starting in the activity at the top of the column.

For instance, there was a 30 percentage point difference in average high

some vocational schools.

school class rank and a one standard deviation difference in average standardized test scores between those attending 4-year colleges only and those not attending college at all. Two-year college students fell roughly in the middle of these two groups. Given these large differences in family background and ability, we would have expected college students-- particularly those attending 4-year colleges-- to have had higher earnings even without attending college. As a result, in the second column we condition on a standardized test score, percentile high school class rank and parental family income in an attempt to control for this source of selection bias.[25] Indeed, including the measures of ability and family backround led to 25-35% decline in the estimated wage differential for a year of college. The magnitude of this ability/background effect is consistent with that in earlier work by Behrman *et. al.* (1980).

The third column of Tables 2a and 2b tests for differences in the wage differentials associated with 2-year and 4-year credits. We also report p-values for the F-test of the constraint that a 2-year college credit was equivalent to a 4-year college credit. In nearly every specification, the hypothesis could not be rejected. A credit at a 2-year college was worth the same as a credit at a 4-year college. This was generally true for both men and women, whether we looked at wages, annual earnings or occupational prestige. In the two specifications where the hypothesis was rejected by the data-- when studying women's occupational prestige or when conditioning on degree certification effects with men's wages-- the point estimate on

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[25] Each member of the base-year survey of the NLS-72 was given a 69 minute test book, consisting of six sections: a vocabulary test (requiring students to recognize synonyms), a picture test (requiring students to be able to recall pictures previously associated with various numbers), a reading test (testing reading comprehension with passages of 100-200 words), a letter group test (a test of inductive skills requiring recognition of patterns in several groups of letters), a mathematics test (comparing the values of various algebraic expressions) and a mosaic test (requiring students to recognize differences in pairs of tile-like patterns). The standardized test score used was the sum of the the scaled scores above, less its mean and divided by its standard deviation.

the 2-year college credits was actually higher than that on 4-year college credits.

The fourth column of Tables 2a and 2b reports the wage, earnings and prestige differentials associated with 2-year and 4-year college credits after conditioning upon degree attainment. (The full set of OLS coefficients is reported in Appendix Tables II and III.) The returns to credits are, therefore, identified by variation in credits among those not receiving degrees as well as by variation in the number of credits taken by those with degrees. We generally continue to find positive and significant coefficients on numbers of credits completed, as each year's worth of credits was associated with a 3-5% increase in both hourly wages and annual earnings. Perhaps surprisingly, however, the estimated "sheepskin effects" of degree completion over and above the value of the credits completed were often small when studying wages and earnings.

There are two exceptions. First, the hourly wages of male four-year college drop-outs are not significantly greater than those of high school graduates after controlling for standardized test scores and family background.[26] Only men completing BA degrees enjoyed positive wage differentials. This was not true when studying annual earnings and we are, therefore, cautious in interpreting this result. Second, there is some evidence for the certification value of an associate's degree for women, probably reflecting the value of the associate's degree in nursing since one-quarter of associate's degrees for women were awarded in the field of nursing. (The coefficient on completing an AA in the annual earnings equation falls by 44% when a dummy is included for nurses.) The evidence for the "sheepskin effects" was stronger, for both men and women, when studying the occupational prestige differentials.

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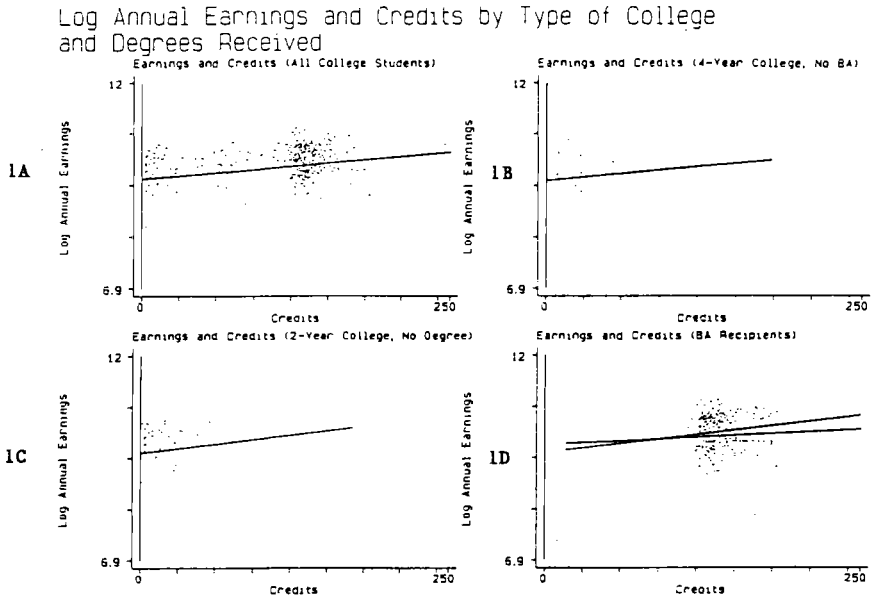
[26] Before conditioning on family background and the ability measures, 4-year drop-outs earned roughly 8% more than high school graduates.

FIGURE 1



NOTE: In graphs 1A - 1C, the OLS fitted line overlaps the data. In graph 1D, the two lines represent the OLS fitted line and the line from 1C.

Figures 1a-1d illustrate the results reported in Tables 2a and 2b graphically. Figure 1a plots log annual earnings, for men and women combined, against the total number of college credits completed. Figure 1b plots log earnings against credits for 4-year college students who reported never completing an associate's, bachelor's or graduate degree. Figure 1c reports log wages against credits for 2-year college drop-outs with no 4-year credits and no degrees. In Figure 1d two lines overlay the data. One reports mean log earnings predicted by the credits and earnings of 2-year college drop-outs. The second is the OLS line for BA recipients, using differences in the number of credits completed by BA recipients to identify returns to a college credit. If a credit at a 2-year college were very different from a credit at a 4-year college, one would expect the slopes of these two lines to be quite different. Further, if there were significant certification effects for degree completion, one would expect the intercept of these two lines to differ.[27] Predicted log earnings for those with 4 years worth of credits is only .10 log points different using the two lines.

Comparison with Census and CPS Data

The findings that two-year college credits are worth roughly the same as four-year college credits and that "sheepskin effects" are small relative to the value

[27]The equation for the various lines are reported below:

Total:	9.622	+	.077*Credits/30 n=4653
	(.012)		(.004)
4-Year,No BA:	9.599	+	.081*Credits/30 n=2033
	(.015)		(.019)
2-Year,No BA:	9.602	+	.112*Credits/30 n=2217
	(.015)		(.018)
BA's:	9.759	+	.048*Credits/30 n=1501
	(.083)		(.017)

of the credits completed-- though contrary to conventional wisdom-- are consistent with previous work studying the returns to single years of schooling completed. Card and Krueger (1992) and Heckman and Polachek (1974) illustrate the essentially linear nature of the relationship between log earnings and years of education among men. If there were large certification effects or if a year's worth of a 2-year credit were worth less than a 4-year credit, one might have expected a discontinuity at 14 years of education (two years of college) and a change in slope between the first two years and the second two years of college. In fact, while there may be some evidence of a discontinuity at the third year of college, those with 1 and 3 years of schooling do seem to have higher earnings than high school graduates.

Ever since 1940, the decennial census and Current Population Survey data have reported number of years of school completed, with no explicit degree information with which to test our findings on the value of credentials as opposed to years of school completed. However, as a pre-test of a new question in the 1990 Census, the February 1990 CPS provides data on degrees received which one can merge with data from the March 1990 CPS reporting number of years of school completed.[28] Paul Siegel of the Bureau of the Census generated the tabulations in Table 4 below, which report mean annual earnings of full-time, full-year workers, aged 25-64, by years of college completed and degrees received with and without

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[28]We do not underestimate the strong prior beliefs held by many regarding the overwhelming importance of credentials rather than years of school completed. Despite the evidence reported in Table 4, the Bureau of the Census elected to change its educational attainment question format in the 1990 Census and the Current Population Surveys. For fifty years between 1940 and 1990, questions regarding educational attainment asked for number of years of school attended and/or completed. Under the revised format, all college drop-outs-- whether they completed one week or 5 years-- are lumped into a single category, "some college," and separate categories have been added for those with AA, BA and graduate degrees. Our results suggest that this was an unfortunate change, since years of schooling completed-- even for those not completing degrees-- is an important determinant of wages. A revised format with two questions-- one with years of schooling and a second identifying degrees completed-- would have been strongly preferrable.

Table 4
Mean Earnings by Years of College Completed and Degrees Received in the February, 1990 CPS

Reported Degree Attainment						
	Unadjusted:					
Years of College Completed:	No College	Some College, No Degree	Occup. AA	Acad. AA	BA	MA
6+					35252	42091
					(1019)	(553)
5					35276	40145
					(835)	(1301)
4		32245	31135	34385	35992	37709
		(1771)	(1674)	(1998)	(312)	(2146)
3		30224	29735	30845	30923	
		(771)	(1025)	(1424)	(1930)	
2		28928	28139	28558		
		(413)	(535)	(603)		
1		26057	24199			
		(348)	(1571)			
High School Graduate	23858	25802	23310			
	(135)	(480)	(1374)			
Adjusted for Gender, Race and Age:						
Years of College Completed:	No College	Some College, No Degree	Occup. AA	Acad. AA	BA	MA
6+					32608	38772
					(837)	(439)
5					33102	37909
					(758)	(901)
4		31100	30707	32771	34124	35036
		(1350)	(1700)	(1480)	(290)	(1592)
3		27738	29184	29813	29791	
		(634)	(1322)	(1377)	(1954)	
2		27264	26534	27245		
		(413)	(660)	(674)		
1		24056	23988			
		(397)	(2042)			
High School Graduate	22070	24382	23339			
	(223)	(516)	(2116)			

Hypothesis Tests:(p-values)

Years Zero within MA	.060	MA=BA within Years	.001
Years Zero within BA	.030	BA=Acad AA within Years	.660
Years Zero within Acad AA	.001	Ac AA=Occ AA within Years	.670
Years Zero within Occ AA	.010	Occ AA-No Deg within Years	.810
Years Zero within Some Coll	.000		

Note: Table from Paul M. Siegel, "Note on the Proposed Change in the Measurement of Educational Attainment in the Current Population Survey" U.S. Bureau of the Census, Draft, February 5, 1991.

adjusting for age, gender and ethnicity. (Standard errors are reported in parentheses.) His results are strikingly consistent with our own. Among those with a given number of years of college completed, there is no distinguishable difference in earnings between those with academic or occupational AA degrees and those with no college degree. Even the additional value of a BA degree seems small.[29] BA recipients with 4 years of college earn roughly 55% more than high school graduates with no college. However, those with 4 years of college and no degree earned roughly 41% more than a high school graduate, suggesting that the bulk (75%) of the value of a BA degree is due to number of years of school completed, not the credential itself. Within each degree category-- MA, BA, academic AA, occupational AA, no college degree-- the number of years of college one had completed led to higher earnings. And conditioning upon years of school completed, one could not reject the hypothesis that a BA degree was equivalent to a AA degree and that having an AA degree was equivalent to having no degree at all. In other words, in the February 1990 CPS data as well, it is years of schooling completed rather than degrees which account for the bulk of postsecondary educational wage differentials.

Comparing Results in the NLS-72 and NLSY

Because the NLS-72 sample members attended community colleges in the mid-Seventies, when these institutions may have been quite different, we sought to compare the NLS-72 results against the experience of more recent cohorts. Although college transcript data are not available, the NLSY provides data on college enrollment and wages for a sample of individuals who would have graduated from high school roughly between 1976 and 1983. In defining educational attainment in both data sets, we first categorized people by their highest degree. For instance, if

[29]Siegel does not report all the relevant standard errors for testing these hypotheses.

a person had an AA as well as a BA, we classified them as BA recipients. A graduate degree took precedence over a BA. We classified college students without degrees by the type of institution they attended, or if they had attended more than one institution, by the type of institution in which they had completed more courses.[30] (In the NLSY data, we use a category "Both two-year and four-year college" since we could not observe the number of courses taken at each.) Hence, the classifications (only attended vocational school, only attended two-year, mostly attended two-year, only attended four-year, mostly attended four-year, vocational school degree, AA, BA, and graduate degree) are mutually exclusive.[31] A summary of these variable definitions are in Table 5.

Results using the NLS-72 and the NLSY are presented in Tables 6a and 6b. The NLS-72 estimates suggest that the hourly wages of 2-year college drop-outs are 10-12% higher than similar high school graduates for women and 8-12% higher than similar high school graduates for men. The NLSY wage results suggest smaller returns for male college drop-outs, roughly 7-9% for community college drop-outs and a bit more for 4-year college drop-outs. The wage results for women in the NLSY suggest very small wage differentials for women, though annual earnings differentials are more similar to the results found elsewhere. These results are consistent with the finding that community colleges generate positive wage differentials even for those not completing an associate's degree and that two-year and four-year college drop-outs fare about equally well. Therefore, it does not seem to be the case that the experience of the NLS-72 cohort was dramatically different

[30] In the NLS-72, only 132 people (3% of the sample) have no degrees and have courses in both two-year and four-year colleges. To weight quarters and semesters, we counted each quarter system credit or course as 0.66 of a semester credit (a rule of thumb suggested by the Association of Independent Colleges and Schools).

[31] We experimented with other classification systems with similar results.

TABLE 5
VARIABLE DEFINITIONS

NLS-72

VARIABLE*	DEFINITION
Only Attended Two-Year/ Four-year College	Only attended the one type of institution and earned no degrees.
Mostly Attended Two-year/ Four-year College	Attended both types of colleges but have no degrees; dummy variable indicates type of college where most courses were completed.
Only Attended Vocational School	If attended private vocational school, but earned no degree. If attended both vocational school and two-year or four-year college, then do not count as having attended vocational school.
Vocational School Degree	Obtained a degree from a vocational school.
AA	Obtained an AA as highest degree.
BA	Obtained BA as highest degree.
Graduate Degree	Obtained a graduate degree.

* All categories are mutually exclusive.

NLSY

VARIABLE*	DEFINITION
Only Attended Two-Year/ Four-year College	Only attended the one type of institution and earned no degrees.
Attended Both	Attended both types of colleges but have no degrees
Only Attended Vocational School	If attended vocational school, but earned no degree. (Note: This excludes apprenticeships, employer-provided training, and "other" forms of training.) If attended both vocational school and two-year or four-year college, then do not count as having attended vocational school.
Other Degree	Obtained a degree other than a High School Diploma, AA, BA, or graduate school degree as highest degree.
AA	Obtained an AA as highest degree.
BA	Obtained BA as highest degree.
Graduate Degree	Obtained a graduate degree.

* All categories are mutually exclusive.

TABLE 6a
RETURNS TO POST-SECONDARY EDUCATION, MALES: OLS RESULTS

	NLS-72*			NLSY**		
	Dependent Variable			Dependent Variable		
Independent Variables	Log Hourly Wage	Log Annual Earnings	Log NORC Prestige Scores	Log Hourly Wage	Log Annual Earnings	Log NORC Prestige Scores
Only Attended Vocational School (No Degree)	-0.0161 (0.0688)	-0.0324 (0.0771)	0.1209 (0.0422)	0.0421 (0.0283)	0.0726 (0.0383)	0.0500 (0.0208)
Only Attended Two-year College (No Degree)	0.0805 (0.0388)	0.1225 (0.0414)	0.1144 (0.0242)	0.0759 (0.0303)	0.0713 (0.0404)	0.0880 (0.0225)
Mostly Attended Two-year College (No Degree)	0.1342 (0.0828)	0.1529 (0.0853)	0.0731 (0.0505)			
Only Attended Four-year College (No Degree)	0.0072 (0.0450)	0.0420 (0.0487)	0.1145 (0.0284)	0.0833 (0.0351)	0.1603 (0.0473)	0.1072 (0.0258)
Mostly Attended Four-year College (No Degree)	-0.0525 (0.0801)	0.2028 (0.0857)	0.1521 (0.0514)			
Attended Both Two- and Four-year College (No Degree)				0.0880 (0.0404)	0.1340 (0.0538)	0.1766 (0.0306)
Vocational School Degree (Highest Degree)	0.1212 (0.0685)	0.0461 (0.0696)	0.1765 (0.0408)			
AA (Highest Degree)	0.0625 (0.0522)	0.0954 (0.0562)	0.1770 (0.0329)	0.2068 (0.0396)	0.2357 (0.0537)	0.1864 (0.0290)
BA (Highest Degree)	0.2415 (0.0382)	0.2835 (0.0418)	0.3091 (0.0242)	0.3386 (0.0304)	0.4223 (0.0407)	0.3671 (0.0227)
Graduate Degree (Highest Degree)	0.2858 (0.0487)	0.3688 (0.0537)	0.4274 (0.0313)	0.4424 (0.0541)	0.6692 (0.0706)	0.5424 (0.0389)
Other Degree (Highest Degree)				0.0781 (0.0663)	0.1789 (0.0897)	0.2989 (0.0480)
Includes Measured Ability/Family Background?	yes	yes	yes	yes	yes	yes
R^2	0.1604	0.1859	0.2974	0.3134	0.3452	0.3176
Number of Observations	2272	2478	2625	2271	2253	2271

* Also included in all NLS-72 regressions are an intercept, controls for the size of the respondent's city in 1973 and for the region of the respondent's high school, a dummy variable indicating employed part-time, self-reported education begun after 1979, parent's income, high school rank, test scores, years of actual experience, number of years with children less than six years old, race, and a dummy variable indicating that the respondent reported a school which had no record of the respondent having attended. The excluded group from the race dummies is White-non-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education. See Appendix IIa for a more complete set of regression results.

** Also included in all NLSY regressions are an intercept, controls for region and urban area in 1990, a dummy variable indicating employed part-time, a dummy variable indicating missing type of college, age in 1979, race, a supplemental sample dummy, parents' education, an afqt score, actual experience. The excluded group from the race dummies is Not-Black/Not-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education. The base group for parents' education are those with no high school diploma. See Appendix IIb for a more complete set of regression results.

Variable definitions are in Table 5.

TABLE 6b
RETURNS TO POST-SECONDARY EDUCATION, FEMALES: OLS RESULTS

	NLS-72*			NLSY**		
	Dependent Variable			Dependent Variable		
Independent Variables	Log Hourly Wage	Log Annual Earnings	Log NORC Prestige Scores	Log Hourly Wage	Log Annual Earnings	Log NORC Prestige Scores
Only Attended Vocational School (No Degree)	0.0292 (0.0518)	-0.0131 (0.0726)	0.1004 (0.0312)	0.0035 (0.0289)	0.1102 (0.0449)	0.0549 (0.0209)
Only Attended Two-year College (No Degree)	0.1191 (0.0345)	0.1024 (0.0508)	0.0840 (0.0216)	0.0360 (0.0287)	0.1323 (0.0436)	0.0897 (0.0209)
Mostly Attended Two-year College (No Degree)	0.1151 (0.0801)	0.2886 (0.1209)	-0.0245 (0.0541)			
Only Attended Four-year College (No Degree)	0.1694 (0.0398)	0.1451 (0.0587)	0.0617 (0.0246)	0.0307 (0.0346)	0.0866 (0.0535)	0.0814 (0.0255)
Mostly Attended Four-year College (No Degree)	0.1838 (0.0715)	0.1693 (0.1030)	0.0832 (0.0437)			
Attended Both Two- and Four-year College (No Degree)				0.0543 (0.0386)	0.1266 (0.0578)	0.0952 (0.0277)
Vocational School Degree (Highest Degree)	0.1277 (0.0640)	-0.0424 (0.0963)	0.0963 (0.0390)			
AA (Highest Degree)	0.2955 (0.0433)	0.2855 (0.0632)	0.2122 (0.0270)	0.1877 (0.0361)	0.3085 (0.0542)	0.2083 (0.0259)
BA (Highest Degree)	0.3001 (0.0329)	0.3023 (0.0486)	0.1724 (0.0206)	0.3311 (0.0305)	0.5130 (0.0461)	0.3034 (0.0222)
Graduate Degree (Highest Degree)	0.4074 (0.0451)	0.4166 (0.0655)	0.2467 (0.0287)	0.4265 (0.0558)	0.5727 (0.0813)	0.3891 (0.0404)
Other Degree (Highest Degree)				0.3152 (0.0633)	0.3483 (0.0938)	0.2613 (0.0447)
Includes Measured Ability/Family Background?	yes	yes	yes	yes	yes	yes
R^2	0.3066	0.3252	0.2516	0.3424	0.3846	0.2790
Number of Observations	2414	2178	2814	2277	2119	2279

* Also included in all NLS-72 regressions are an intercept, controls for the size of the respondent's city in 1973 and for the region of the respondent's high school, a dummy variable indicating employed part-time, self-reported education begun after 1979, parent's income, high school rank, test scores, years of actual experience, number of years with children less than six years old, race, and a dummy variable indicating that the respondent reported a school which had no record of the respondent having attended. The excluded group from the race dummies is White-non-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education. See Appendix IIa for a more complete set of regression results.

** Also included in all NLSY regressions are an intercept, controls for region and urban area in 1990, a dummy variable indicating employed part-time, a dummy variable indicating missing type of college, age in 1979, race, a supplemental sample dummy, parents' education, an afqt score, actual experience. The excluded group from the race dummies is Not-Black/Not-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education. The base group for parents' education are those with no high school diploma. See Appendix IIb for a more complete set of regression results.

from that of high school classes graduating more recently.

Implications

If it is difficult for employers to observe the number of college credits students have completed, then these findings can be taken as supportive of a human capital, as opposed to signalling, explanation of demand for education. Altonji (1992) uses such reasoning in studying wage differentials by number of credit hours completed by high school graduates, in making the opposite case that the high school diploma, not high school courses taken, is the important high school outcome.[32] Further, it may not be surprising to find similar returns to 2-year and 4-year college credits, if students are deciding between the two types of institutions on the margin. Although tuition levels can be quite different between the two, opportunity costs--which represent the bulk of the cost of postsecondary education-- are similar.

However, there may be reasons why we are overstating the returns for dropouts, although it involves a selection bias which runs in the opposite direction than that which is usually believed. For example, students may search for jobs while enrolled in school and only those who receive high wage offers leave school without finishing their degrees. Indeed, some earlier work which followed community college drop-outs and associate degree holders has found that drop-outs actually had higher earnings than the associate degree completers.[33] The usual selection story one hears suggests that degree completers may be found to have higher earnings even without a signal value of the degree, since the same trait which leads students to

[32]In his results, there was little difference in wages for those completing different amounts of high school credits, a finding which he interprets as challenging the human capital model.

[33]Pincus (1980).

finish a degree may be valued by employers. We have no data with which to test this hypothesis. However, whether they are an endorsement of the human capital model or a stimulus for thinking about other sorts of selection, the finding of small credentialling effects is provocative.

IV. Measurement Error and Self-Selection: Instrumental Variables Results

In the previous section, we reported OLS estimates of the returns to transcript-measured college credits after attempting to control for family background and ability measures. However, there are at least two potential problems with these estimates: First, due to measurement error in the transcript-reported schooling variable, we may have understated the returns to schooling. Second, the ability/background measures may fail to control adequately for the differences between college students and high school graduates so that we have overstated the returns to schooling. Suppose we were interested in estimating the returns to schooling in the following simple framework:

$$Y_i = \alpha + \beta S_i + \gamma A_i + \eta_i \qquad (1)$$

where Y is log wage, S is actual years of schooling and A is some ability measure. Suppose that instead of S, we observe some measure of schooling, S_1, with some additive measurment error, ϵ_1. If we were to estimate the returns to one imperfect measure of schooling, we would estimate the following equation:

$$Y_i=\alpha + \beta S_{1i}+\gamma A + (\eta-\beta\epsilon_{1i}) \qquad (2)$$

The above illustrates the double dilemma that we face in estimating the returns to schooling as described by Griliches (1979). On the one hand, there is the familiar problem that one might expect those with higher earnings capacity to have completed more schooling.[34] On the other hand, even if we have some measures of ability, A, with which to control for selection effects, we will understate the

[34]Griliches (1979) provides an illustration of how endogeneity of the schooling choice could lead to the opposite selection story.

returns to schooling by using an imperfect measure of years of schooling, since S_i and ϵ_i are by definition positively correlated. This problem would be exacerbated if A is correlated with years of schooling.[35]

As a result, in this section, we pursue two separate instrumental variables strategies. First, we continue to use family background and ability measures to control for any selection bias, but employ self-reported education as an instrument for transcript-reported education, which may be measured with error due to differences in credit accounting between schools. Second, we employ a second set of instrumental variables using variation in public 2-year and 4-year tuition as well as distance from 2-year and 4-year colleges as random sorting mechanisms that assign people to different types of college. In pursuing the IV strategy, we assume that the first instrument (self-reported education) is orthogonal to the measurement error in the transcript credit counts and that the second set of instruments (tuition and proximity) are orthogonal to both the measurement error in the credits as well as to any other differences between high school graduates and college students.

Controlling for Measurement Error in the Transcript Number of Credits

Although our measures of attendance are based upon postsecondary transcripts, there is variation among schools in the meaning of a college credit. For instance, although we have crudely adjusted for the difference between quarter-system and semester credits, a credit at University of North Carolina will mean something different from a credit at the University of Massachusetts at Amherst.

[35] In the words of Griliches (1979), "We may kill the patient in our attempts to cure what may have been a rather minor disease originally" by controlling for other factors correlated with years of schooling.

However, we have two measures of schooling: transcript-reported and self-reported.[36] Whatever the form of the misreporting of self-reported education, all we need for a valid instrument is that the self-reported education be orthogonal to the measurement error in the transcript measure of schooling for the IV strategy to be valid.[37] As a result, we use self-reported education as an instrument for transcript-measured education, while continuing to condition upon family background and ability measures.

In the first column in Table 7 below, we report the OLS log annual earnings differential on 30 completed college credits in a pooled sample of men and women *without* conditioning upon family background and ability measures. In the second column, we report the same figure after including measures of high school class rank, family income and the standardized test score. As reported earlier,

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[36] We can estimate the magnitude of the measurement error if we assume that ϵ_1 and ϵ_2 are independent and that both are independent of S. We can then identify the variance in true schooling, σ_{s2}, as well as the variance in each of the errors in measurement. Having observed S_1 and S_2 for each person, we have three moments with which to work. We can express each of these as follows:

$$Var(S_1) = \sigma_s^2 + \sigma_{e_1}^2$$

$$Var(S_2) = \sigma_s^2 + \sigma_{e_2}^2$$

$$Cov(S_1, S_2) = \sigma_s^2$$

The sample moments yield estimates of $\sigma_s^2 = 3.08, \sigma_{\epsilon 1}^2 = .49$ (measurement error in the self-reported schooling) and $\sigma_{\epsilon 2}^2 = .37$ (measurement error in the transcript-measured schooling), suggesting that 11% of the variance in transcript-reported education is measurement error and that 14% of the variation in self-reported education is measurement error. Both estimates are similar to estimates of measurement error in schooling generated by Bishop (1974).

[37] This may not be a valid assumption for that portion of the measurement error due to school-specific degree requirements, given the fact that student self-reports may be a function of how a person's school classifies students. In this case, the IV strategy is likely to lead to an understatement of the returns to schooling.

conditioning upon family background and ability in OLS leads to a 25% decline in the estimated differential, from 0.08 to 0.06. In the third column of column 7, we report the IV estimate of the returns to schooling, using self-reported education to instrument for years of schooling, but continuing to condition upon family background and ability. The point estimate again rises to approximately 8.4% per year of schooling. Further, the test reported in Table 7 would not lead us to reject the 8% estimate with which we started.

Table 7

Coefficient on Total Credits from Log-Annual Earnings Equation
With and Without Ability and Measurement Error Correction
(Standard Errors in Parentheses)

Dependent Variable: Log Annual Earnings	OLS (1)	OLS (2)	IV (3)
Total Number of College Credits	.080 (.005)	.063 (.005)	.084 (.008)
HS Rank, Test Score, Family Income Included		X	X
Test of $\beta = .08$ (p-value)[38]	.978	.002	.601

Notes: There were 2805 observations used in these specifications, pooling men and women. See notes to Table 9 for other regressors in the equations. The IV estimator was calculated by means of 2SLS using self-reported years of education as an instrument for transcript reported education.

Ashenfelter and Krueger (1992) use a similar strategy in a sample of twins, using first differences between twins to "control for" ability effects and using each

[38] This is too weak a criterion, since there is likely to be a covariance between the OLS and IV estimator. In future versions of the paper, we will present a more suitable specification test.

twins' report on his brother's or sister's schooling as instruments on the schooling measure. Although their estimates are much higher, the point is the same: OLS estimates of the returns to schooling in CPS data do not seem overstated even though they exclude ability or background controls, since there is an offsetting downward bias due to measurement error in the schooling variable.[39]

Another Attempt to Control for Self-Selection

In the preceding OLS analysis and in the first set of IV estimate above, we have attempted to control for differences between students attending different types of colleges by conditioning explicitly upon standardized test scores, family income and high school class rank. Either because of inappropriate functional form assumptions or other exclusions, however, we may not have succeeded in controlling for the ways in which two- and four-year college students differ from one another and from high school graduates. For instance, if two-year or four-year college entrants are "more motivated" than high school graduates with similar scores and family background, the earlier results would overstate educational wage differentials. In this section, we correct for self-selection as well as measurement error bias by employing two instrumental variables-- distance from the closest 2-year and 4-year college as well as state public tuition at 2-year and 4-year colleges-- that one might take as orthogonal to both the measurement error and ability differences.

States vary widely in their provision of a community college alternative. Post-secondary enrollment in community colleges ranges from roughly half of FTE

[39] The Ashenfelter and Krueger (1992) point estimate may be much higher simply because differencing within twin pairs may not eliminate all of the ability/background differences. In fact, one could imagine such differencing could make matters worse, if twins with different levels of education are more different from one another than unrelated individuals with different levels of education.

enrollment in California to less than 10% in such states as Louisiana and Indiana. The NLS-72 contains information on miles from the respondents' high school to the closest 2-year and 4-year college as reported by high school counselors. There is also wide variation in the cost of public tuition between states. In earlier work with the NLS-72, Manski and Wise (1983) found both distance and tuition to be correlated with where and whether one enrolled in college. In order to avoid picking up regional, rural-urban, or socio-economic differences with these instruments, we include region dummies, city-size dummies, and controls for family background and measured ability in the wage and earnings equations.[40]

Table 8
First-Stage Results from TSLS Using the NLS-72, Men and Women Combined

Instrument	Endogeneous Variable			
	Total Two-year College Credits/30	Total Four-year College Credits/30	Only/Mostly Attended Two-year College	Only/Mostly Attended Four-year College
Two-year College Tuition (x100)	-0.0659 (0.0081)	-0.0146 (0.0179)	-0.0284 (0.0033)	-0.0011 (0.0033)
Four-year College Tuition (x100)	-0.0013 (0.0063)	-0.0378 (0.0139)	-0.0032 (0.0025)	-0.0095 (0.0026)
Miles to Nearest Two-year College (x10)	-0.0114 (0.0030)	0.0194 (0.0066)	-0.0055 (0.0012)	0.0042 (0.0012)
Miles to Nearest Four-year College (x10)	0.0025 (0.0031)	0.0044 (0.0068)	0.0009 (0.0012)	0.0004 (0.0013)
R^2	0.0685	0.4835	0.1131	0.4653

NOTES: The coefficients in the last two columns are from a linear-probability model. See notes for Table 2 for other covariates. There are 4453 observations.

[40]We also found our results to be quite sensitive to the inclusion of a dummy to identify those living in California. California is a high wage state in addition to having particularly low tuition levels. When we exclude the California dummy, the point estimates on years of schooling rise to roughly 16-18%.

Table 8 above shows the first-stage results describing the relationship between the numbers of credits earned in two-year and four-year colleges and distance and tuition.

Conditional on miles to the nearest four-year college and four-year college tuition, the proximity and price of two-year college significantly affect the total number of two-year credits earned and the probability that one attends two-year college. Similarly, the more expensive the four-year college tuition, the fewer four-year credits one earns and the less likely one is to attend a four-year college. With a few exceptions, the results indicate that the instruments are significant determinants of the type of college attended.

In columns (1) and (2) of Table 9, we report IV estimates of returns to 30 college credits using only state public 2-year and 4-year college tuition as instruments. In the top half of Table 9, we continue to condition upon the family background and ability measures, while these are excluded in the bottom panel. As long as tuition is truly orthogonal to ability and family background, both should be consistent. Although the point estimates in column (1) are actually higher (11.6%) we would not reject the 8% estimate. In column 2, the standard errors are too large to distinguish between 2-year and 4-year college credits when using only public 2-year and 4-year tuition as instruments. Further, the IV estimates are similar whether or not one also conditions upon background and ability, suggesting that tuition rates are at least orthogonal to test scores and family background, once we include race and regional measures. One might take the test of overidentification in the bottom of column 1 as well as the similarity of the top and bottom panels as suggestive that the tuition measures are unrelated to other unmeasured determinants of wages as well.

In columns (3) and (4) of Table 9, we include distance as well as tuition

Table 9

IV Estimates Using Public Tuition, Distance from College and Parental Education As Instruments

Dependent Variable: Log Annual Earnings

Fam Back, Abil Included:	(1)	(2)	(3)	(4)	(5)	(6)
Total Credits/30	.116		.094		.080	
	(.045)		(.042)		(.024)	
Total 2-Year Credits/30		.068		.125		.116
		(.119)		(.060)		(.055)
Total 4-Year Credits/30		.151		.075		.074
		(.090)		(.050)		(.025)
Test of β=.08 (p-value)	.4231	.6651	.7273	.7324	.9885	.7725
Test of Over-Id (p-value)	.8781	.8231	.7461	.6990	.7090	.6939
No Fam Back, Abil:	(1)	(2)	(3)	(4)	(5)	(6)
Total Credits/30	.113		.091		.122	
	(.035)		(.033)		(.015)	
Total 2-Year Credits/30		.077		.136		.144
		(.116)		(.061)		(.058)
Total 4-Year Credits/30		.127		.075		.121
		(.056)		(.037)		(.015)
Test of β=.08 (p-value)	.3473	.6131	.7323	.6353	.0045	.0165
Test of Over-Id (p-value)	.9370	.8875	.5071	.4628	.5869	.5344
Instrumental Variables:						
Public Tuition (2-,4-Yr)	X	X	X	X	X	X
Distance (2-,4-Yr)			X	X	X	X
Parental Education					X	X

Note:Each of these specifications was estimated also including race, years experience, number of years with kids under 6, gender, an interaction between gender and years with kids, city size, region, part-time status and a dummy for living in California in 1979. There were 4021 observations. When instrumenting for tuition, we used tuition at a 2-year college, tuition at a 4-year college and the interaction between the two. We used a similar strategy for distance. Education of the mother as well as the father was measured with 10 dummy variables.

measures as instruments. Although they do allow the IV estimator to distinguish between 2-year and 4-year credits more precisely, the inclusion of the distance measures has little impact on the estimates. In column (5) and (6), we introduce parental education as additional instruments on years of schooling. There is a wide body of literature such as that of Behrman, Taubman and Wales (1980) suggesting that parental education is orthogonal to earnings once one conditions upon own years of schooling. (Others such as Korenman and Neumark (1990) have used the same IV strategy.) The addition of the parental education has little impact on the point estimate, which declines from 9.4% to 8%, but tightens the standard errors considerably. The overidentification tests again would not lead us to reject these instruments as invalid.

For each set of estimates in Table 9, we report a test of the hypothesis that the wage differential for a year of schooling is simply 8%, the original OLS point estimate. In no case would we have rejected the 8% figure as too high.[41] (In fact, when we do not control for family income and ability and use parental education as instruments, we find estimates in the range of 11%. However, though the overidentification tests would not lead us to reject these results, we are uncomfortable using parental education as an instrument without controlling for family income or test scores.) Although the two sets of instruments are identified along different margins, the results are similar.

Quite ironically, our results suggest that despite our considerable efforts in using transcript data to identify two-year and four-year college credits and degrees, as well as controlling for family background and ability effects, it all made little

[41]This is too weak a criterion, however, since there will be some covariance between the two estimators. In future versions of the paper, we will report specification tests of the OLS estimates.

difference in the end. A year at a 2-year college was worth roughly the same as a year at a 4-year college and the credentialling effects of degree completion are not large (except, possibly, for female AA recipients and male BA recipients.) Further, despite the past emphasis on selection effects in measuring the returns to schooling, we seem to be understating the returns to schooling by worrying only about selection rather than measurement error in the schooling variable.[42] Since the effects of measurement error and selection bias are roughly offsetting, the OLS estimates of the returns to a year of schooling of 8-9% are roughly correct in our data, even without controlling for family background or ability.

[42] Angrist and Krueger (1991b) also find that OLS and TSLS yield similar results.

V. Conclusion

These results come against a backdrop of skepticism regarding the value of a community college education. Most previous estimates of the returns to community college using earlier waves of the NLS-72 suggested little or no wage effects (Breneman and Nelson (1981), Anderson (1984), and Monk-Turner (1983)). These previous results seem to have observed wages too early in the life-cycle to identify returns to education.[43]

Much of the skepticism regarding the value of a community college education is due to the very high drop-out rates. Indeed, many community college students complete very few credits. Figure 2 reports the number of courses completed by those attending only a 2-year college, those attending a 4-year college, and for drop-outs from each.[44] (The 13% of the sample with both types of credits were excluded in generating Figure 2.) Of those who dropped out of 2-year colleges without going on to 4-year schools, 40% completed fewer than a semester's worth of credits (15 credits).

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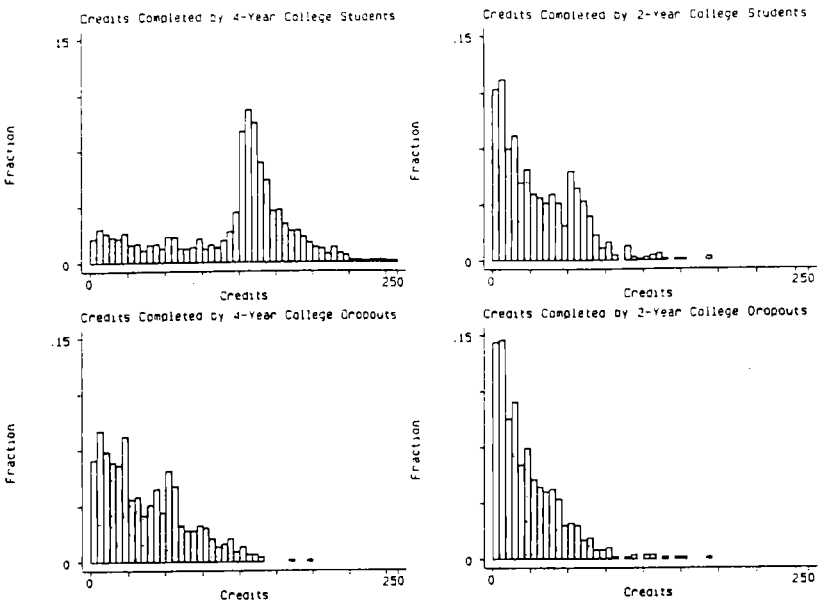
[43] In a concurrent study, Grubb (1993) concludes that two-year college credits alone are worthless and that that there are no earnings gains for men who complete an AA, although he finds gains for women who complete an AA. The discrepancies in our results are most likely due to the fact that Grubb uses a different version of the transcript data, subject to even greater measurement error. Adelman (1990) finds many coding errors in the original PETS file. Accordingly, we use Adelman's "cleaned" version of the PETS. Further, Grubb only reports the returns to college credits when differentiated by field of credit-- vocational or academic. While we can reproduce a similar result, the data seem only to be saying that there is not enough information to distinguish between credits in various fields, not that college credits are worthless without degrees. We are encouraged that our strongest results are found when we use a dummy variable specification which is less subject to error, rather than number of credits, and that we found similar results in the NLSY.

[44] Roughly a third (30%) of those initially entering a 2-year college eventually completed an associate's degree and a third went on to 4-year colleges. (These groups overlapped, so that roughly 15% of 2-year college entrants completed an AA degree and attended a 4-year college.)

FIGURE 2. CREDITS COMPLETED BY TYPE OF COLLEGE AND DEGREE COMPLETION



Critics of community colleges might interpret our results as suggesting that the magnitudes of the wage differentials for those completing only a few credits are too small to be economically meaningful. However, it is important to keep in mind that this is an ex post wage differential. As Comay et. al. (1973), Manski (1989) and Altonji (1991) have argued, there may be an "option value" to college entry if students are able to gain more information about the costs and benefits of further investments. When one is uncertain about the prospects of completing college before entry, there will be a value attached to running an experiment and enrolling in order to discover whether one is "college material." The pattern of course-taking in Figure 2, with very high drop-out rates early in both 2-year and 4-year colleges, is consistent with such a view of the demand for education. Those who do not exercise the option of completing college and leave after only a few credits may enjoy only small wage differentials. However, it would be inaccurate to describe college as not having been worthwhile for this group, because the ex ante returns may indeed have been large enough to justify the public and the private investments. This insight is particularly important in considering the desirability of such policies as graduation-contingent student aid.

As an increasing proportion of high school graduates seek to improve their skills in the face of rising wage inequality, the community college is becoming an increasingly important institution in the U.S. labor market. Roughly 50% of those entering college today do so at community colleges. However, even this figure probably understates their importance since community colleges are the port of entry for a disproportionate share of those marginal students most likely to be affected by state and federal financial aid policies. Despite the increasing importance of the community college as a labor market instutition, the lack of data has resulted in little work in the area. There is a clear need for more data with which to evaluate them.

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APPENDIX Ia

SAMPLE MEANS AND STANDARD DEVIATIONS

NLS-72

	WOMEN		MEN	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Log Hourly Wage (1986)	2.289	1.372	2.618	1.340
Log Annual Earnings (1984-85)	9.509	.696	10.005	.545
Log NORC Prestige Score (1986)	3.788	.290	3.734	.337
Total College Credits/30	2.038	2.160	2.257	2.219
Total 2-Year Credits/30	.312	.729	.344	.764
Total 4-Year Credits/30	1.726	2.133	1.913	2.204
AA (Transcript,Pre-1980)	.047	.209	.036	.185
BA (Transcript,Pre-1980)	.281	.450	.289	.453
Grad Degree (Trans,Pre-1980)	.036	.188	.036	.187
AA (Transcript,Post-1979)	.008	.090	.008	.090
BA (Transcript,Post-1979)	.019	.137	.034	.182
Grad Degree (Trans,Post-1979)	.036	.185	.049	.216
AA (Self-Rep,Post-1979)	.011	.104	.009	.096
BA (Self-Rep,Post-1979)	.010	.097	.012	.108
Grad Degree (Self-Rep,Post-1979)	.027	.162	.026	.159
Only Attended Two-year College	.101	.301	.102	.302
Mostly Attended Two-year College	.011	.104	.013	.113
Only Attended Four-year College	.079	.270	.084	.278
Mostly Attended Four-year College	.012	.108	.014	.116
Attended Vocational School	.038	.191	.018	.134

(Table continues on next page...)

APPENDIX Ia (cont.)

SAMPLE MEANS AND STANDARD DEVIATIONS

NLS-72

	WOMEN		MEN	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Family Income Missing	0.210	0.407	0.136	0.343
Family Income ($1980)	$10,865	4.818	$11,545	4,911
% Rank in High School (x100)	63.76	26.00	52.5	27.7
Standardized Ability Score	.138	.944	.013	.984
Black	0.108	0.311	0.063	0.243
Hispanic	0.048	0.214	0.049	0.216
Other (non-White)	0.042	0.202	0.046	0.210
Northeast	0.157	0.364	0.173	0.378
Northcentral	0.224	0.417	0.233	0.423
South	0.218	0.413	0.204	0.403
Small City	0.326	0.469	0.321	0.467
Medium City	0.216	0.411	0.201	0.410
Large City	0.199	0.399	0.187	0.390
Very Large City	0.115	0.319	0.133	0.339
Years Actual Experience	10.02	2.66	10.93	2.31
Years with Kids <6 yrs old	4.52	4.47	4.17	4.15
Employed Part-time	0.206	0.405	0.068	0.252
Liar Flag	0.046	0.209	0.038	0.191
Number of Observations	2192		2475	

APPENDIX Ib

SAMPLE MEANS AND STANDARD DEVIATIONS

NLSY

Variable	MEN		WOMEN	
	Mean	Std. Dev.	Mean	Std. Dev.
Log Hourly Wage	2.28	0.488	2.06	0.494
Log Annual Earnings	9.91	0.645	9.52	0.734
Log NORC Prestige Score	3.57	0.361	3.65	0.340
Years of School Completed	13.45	1.99	13.44	1.88
Only Attended Two-year College	0.125	0.331	0.150	0.357
Only Attended Four-year College	0.083	0.276	0.089	0.284
Attended Both Two-year and Four-year College	0.057	0.232	0.066	0.249
Attended Vocational School	0.141	0.349	0.138	0.345
Other Degree (Highest Degree)	0.018	0.133	0.020	0.139
AA (Highest Degree)	0.060	0.237	0.078	0.268
BA (Highest Degree)	0.190	0.393	0.188	0.391
Graduate Degree	0.035	0.184	0.030	0.171
Father's Education Missing	0.116	0.321	0.118	0.322
Father is High School Graduate	0.324	0.468	0.331	0.471
Father has Some College	0.093	0.290	0.079	0.271
Father is Four-year College Grad	0.148	0.355	0.140	0.347
Mother's Education Missing	0.047	0.211	0.037	0.190
Mother is High School Graduate	0.438	0.496	0.406	0.491
Mother has Some College	0.107	0.310	0.093	0.291
Mother is Four-year College Grad	0.080	0.271	0.075	0.264

(Table continues on next page...)

APPENDIX Ib (cont.)

SAMPLE MEANS AND STANDARD DEVIATIONS

NLSY

Variable	MEN		WOMEN	
	Mean	Std. Dev.	Mean	Std. Dev.
AFQT Score (adjusted)	7.88	23.79	8.48	20.07
Black	0.243	0.429	0.261	0.439
Hispanic	0.140	0.347	0.135	0.342
Supplemental Sample Dummy	0.402	0.490	0.427	0.495
Age in 1979	17.3	2.31	17.4	2.24
Northeast	0.177	0.382	0.192	0.394
Northcentral	0.255	0.436	0.228	0.420
South	0.374	0.484	0.405	0.491
Urban	0.793	0.405	0.796	0.403
Total Weeks Worked 1975-1990 (Imputed)	451.8	148.7	417.2	157.3
Employed Full-time	0.952	0.214	0.805	0.396
Missing College Type	0.012	0.110	0.012	0.108
Number of Observations	2270		2277	

APPENDIX IIa

RETURNS TO COLLEGE CREDITS, MALES: OLS RESULTS
NLS-72

Dependent Variable: Log Hourly Wage

	Credits by Type of College/30		
	Dependent Variable		
Independent Variables	Log Hourly Wage	Log Annual Earnings	Log NORC Prestige Scores
Total Number of Two-year College Credits/30	0.0492 (0.0139)	0.0707 (0.0153)	0.0329 (0.0091)
Total Number of Four-year College Credits/30	0.0159 (0.0105)	0.0552 (0.0117)	0.0339 (0.0070)
AA	-0.1118 (0.0548)	-0.0997 (0.0605)	-0.0034 (0.0358)
BA	0.1581 (0.0443)	0.0574 (0.0491)	0.0821 (0.0293)
Graduate Degree	0.2409 (0.0707)	0.1132 (0.0799)	0.1573 (0.0476)
Black	-0.0569 (0.0408)	-0.0397 (0.0442)	-0.0354 (0.0256)
Hispanic	-0.0045 (0.0438)	0.0073 (0.0471)	0.0324 (0.0278)
Other	-0.0049 (0.0416)	-0.0892 (0.0464)	-0.0223 (0.0262)
Parent's Income Missing	0.0063 (0.0252)	0.0005 (0.0282)	0.0117 (0.0160)
Parent's Income (x1000) ($1980)	0.0098 (0.0019)	0.0165 (0.0021)	0.0023 (0.0013)
% Rank in High School (x100)	0.1025 (0.0427)	0.0959 (0.0474)	0.0422 (0.0273)
Standardized Test Score	0.0314 (0.0126)	0.0190 (0.0142)	0.0509 (0.0082)
Years Actual Experience	0.0334 (0.0042)	0.0542 (0.0046)	0.0053 (0.0025)
Years with Kids <6 years Old	0.0067 (0.0023)	0.0147 (0.0025)	-0.0001 (0.0015)
R^2	0.1785	0.1952	0.2978
Number of Observations	2262	2477	2624

NOTE: Also included in all regressions are an intercept, controls for the size of the respondent's city in 1973 and for the region of the respondent's high school, a dummy variable indicating employed part-time, dummy variables for education begun after 1979, and a dummy variable indicating that the respondent reported a school which had no record of the respondent having attended. The excluded group from the race dummies is White-non-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education.

Variable definitions are in Table 5.

APPENDIX IIb

RETURNS TO POST-SECONDARY EDUCATION, MALES: OLS RESULTS NLSY

Independent Variables	Dependent Variable		
	Log Hourly Wages	Log Annual Earnings	Log NORC Prestige
Only Attended Vocational School (No Degree)	0.0421	0.0726	0.0500
	(0.0283)	(0.0383)	(0.0208)
Only Attended Two-year College (No Degree)	0.0759	0.0713	0.0880
	(0.0303)	(0.0404)	(0.0225)
Only Attended Four-year College (No Degree)	0.0833	0.1603	0.1072
	(0.0351)	(0.0473)	(0.0258)
Attended Both Two- and Four-year College (No Degree)	0.0880	0.1340	0.1766
	(0.0404)	(0.0538)	(0.0306)
AA (Highest Degree)	0.2068	0.2357	0.1864
	(0.0396)	(0.0537)	(0.0290)
BA (Highest Degree)	0.3386	0.4223	0.3671
	(0.0304)	(0.0407)	(0.0227)
Graduate Degree (Highest Degree)	0.4424	0.6692	0.5424
	(0.0541)	(0.0706)	(0.0389)
Other Degree (Highest Degree)	0.0781	0.1789	0.2989
	(0.0663)	(0.0897)	(0.0480)
Black	-0.0377	-0.0001	-0.0552
	(0.0273)	(0.0366)	(0.0201)
Hispanic	-0.0606	-0.0020	0.0184
	(0.0311)	(0.0412)	(0.0229)

(Table continues on next page...)

APPENDIX IIb (cont.)

RETURNS TO POST-SECONDARY EDUCATION, MALES: OLS RESULTS
NLSY

Independent Variables	Dependent Variable		
	Log Hourly Wages	Log Annual Earnings	Log NORC Prestige
Supplemental Sample Dummy	-0.0329	-0.0640	-0.0098
	(0.0217)	(0.0289)	(0.0160)
Father's Education			
Missing	-0.0003	-0.0087	-0.0236
	(0.0308)	(0.0416)	(0.0226)
High School Diploma	0.0121	0.0265	0.0151
	(0.0233)	(0.0313)	(0.0171)
Some College	0.0148	0.0085	-0.0309
	(0.0348)	(0.0463)	(0.0259)
College Graduate	0.0453	0.0490	0.0228
	(0.0343)	(0.0453)	(0.0252)
Mother's Education			
Missing	0.0145	0.0307	-0.0177
	(0.0437)	(0.0590)	(0.0324)
High School Diploma	0.0231	0.0005	-0.0207
	(0.0227)	(0.0304)	(0.0167)
Some College	0.0550	-0.0043	0.0538
	(0.0344)	(0.0461)	(0.0257)
College Graduate	0.0587	-0.0201	0.0098
	(0.0418)	(0.0553)	(0.0308)
AFQT Score (adjusted)	0.0026	0.0033	0.0019
	(0.0005)	(0.0006)	(0.0003)
Number of Weeks Worked 1975-1990 (x10)	0.0091	0.0254	0.0027
	(0.0028)	(0.0040)	(0.0021)
Number of Weeks Worked Squared (x100000)	0.0005	-0.0693	0.0016
	(0.0331)	(0.0464)	(0.0245)
R^2	0.3134	0.3452	0.3176
Number of Observations	2270	2253	2271

NOTE: Also included in all regressions are an intercept, controls region and urban area in 1990, a dummy variable indicating employed part-time, a dummy variable indicating missing type of college, age in 1979, and dummies for parents' occupations. The excluded group from the race dummies is Not-Black/Not-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education. The base group for parents' education are those with no high school diploma.

Variable definitions are in Table 5.

APPENDIX IIIa

RETURNS TO COLLEGE CREDITS, FEMALES: OLS RESULTS
NLS-72

	Credits by Type of College/30		
	Dependent Variable		
Independent Variables	Log Hourly Wage	Log Annual Earning	Log NORC Prestige
Total Number of Two-year College Credits/30	0.0435	0.0289	0.0350
	(0.0139)	(0.0205)	(0.0090)
Total Number of Four-year College Credits/30	0.0366	0.0392	0.0245
	(0.0111)	(0.0165)	(0.0072)
AA	0.0847	0.1517	0.0796
	(0.0471)	(0.0702)	(0.0299)
BA	0.0531	0.0811	0.0152
	(0.0460)	(0.0691)	(0.0302)
Graduate Degree	0.1204	0.1748	0.0409
	(0.0699)	(0.1045)	(0.0464)
Black	0.0941	0.1436	-0.0057
	(0.0311)	(0.0458)	(0.0193)
Hispanic	0.0772	0.3115	0.0655
	(0.0416)	(0.0588)	(0.0253)
Other	0.0246	0.1223	0.0012
	(0.0388)	(0.0597)	(0.0250)
Parent's Income Missing	0.0032	0.0085	0.0088
	(0.0195)	(0.0294)	(0.0121)
Parent's Income (x1000) ($1980)	0.0112	0.0131	0.0016
	(0.0018)	(0.0027)	(0.0012)
% Rank in High School (x100)	0.1011	0.1075	0.1086
	(0.0412)	(0.0615)	(0.0257)
Standardized Test Score	0.0513	0.0345	0.0447
	(0.0128)	(0.0193)	(0.0080)
Years Actual Experience	0.0428	0.0669	0.0122
	(0.0030)	(0.0048)	(0.0018)
Years with Kids <6 years Old	-0.0052	-0.0180	-0.0008
	(0.0021)	(0.0031)	(0.0013)
R^2	0.3096	0.3225	0.2518
Number of Observations	2408	2178	2814

NOTE: Also included in all regressions are an intercept, controls for the size of the respondent's city in 1973 and for the region of the respondent's high school, a dummy variable indicating employed part-time, dummy variables for education begun after 1979, and a dummy variable indicating that the respondent reported a school which had no record of the respondent having attended. The excluded group from the race dummies is White-non-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education.

Variable definitions are in Table 5.

APPENDIX IIIb

RETURNS TO POST-SECONDARY EDUCATION, FEMALES: OLS RESULTS NLSY

Independent Variables	Dependent Variable		
	Log Hourly Wages	Log Annual Earnings	Log NORC Prestige
Only Attended Vocational School (No Degree)	0.0035 (0.0289)	0.1102 (0.0449)	0.0549 (0.0209)
Only Attended Two-year College (No Degree)	0.0360 (0.0287)	0.1323 (0.0436)	0.0897 (0.0209)
Only Attended Four-year College (No Degree)	0.0307 (0.0346)	0.0866 (0.0535)	0.0814 (0.0255)
Attended Both Two- and Four-year College (No Degree)	0.0543 (0.0386)	0.1266 (0.0578)	0.0952 (0.0277)
AA (Highest Degree)	0.1877 (0.0361)	0.3085 (0.0542)	0.2083 (0.0257)
BA (Highest Degree)	0.3311 (0.0305)	0.5130 (0.0461)	0.3034 (0.0222)
Graduate Degree (Highest Degree)	0.4265 (0.0558)	0.5727 (0.0813)	0.3891 (0.0404)
Other Degree (Highest Degree)	0.3152 (0.0633)	0.3483 (0.0938)	0.2613 (0.0047)
Black	0.1038 (0.0268)	0.0885 (0.0408)	0.0487 (0.0193)
Hispanic	0.1691 (0.0311)	0.0717 (0.0471)	0.1186 (0.0227)

(Table continues on next page...)

APPENDIX IIIb (cont.)

RETURNS TO POST-SECONDARY EDUCATION, FEMALES: OLS RESULTS
NLSY

Independent Variables	Dependent Variable		
	Log Hourly Wages	Log Annual Earnings	Log NORC Prestige
Supplemental Sample Dummy	-0.0595	-0.0057	-0.0088
	(0.0209)	(0.0319)	(0.0151)
Father's Education			
Missing	-0.0219	0.0015	-0.0170
	(0.0299)	(0.0461)	(0.0217)
High School Diploma	0.0219	0.0292	0.0311
	(0.0230)	(0.0349)	(0.0166)
Some College	0.0141	-0.0173	-0.0148
	(0.0357)	(0.0531)	(0.0258)
College Graduate	0.0283	0.0350	0.0550
	(0.0338)	(0.0507)	(0.0245)
Mother's Education			
Missing	-0.0401	0.1000	-0.0347
	(0.0475)	(0.0743)	(0.0342)
High School Diploma	0.0228	-0.0408	0.0127
	(0.0218)	(0.0331)	(0.0158)
Some College	-0.0017	-0.0277	-0.0173
	(0.0349)	(0.0521)	(0.0256)
College Graduate	0.1142	-0.0113	0.0360
	(0.0405)	(0.0609)	(0.0294)
AFQT Score (adjusted)	0.0037	0.0040	0.0019
	(0.0005)	(0.0008)	(0.0004)
Number of Weeks Worked 1975-1990 (x10)	0.0038	0.0270	0.0038
	(0.0023)	(0.0042)	(0.0017)
Number of Weeks Worked Squared (x100000)	0.0740	-0.0902	0.0061
	(0.0296)	(0.0504)	(0.0214)
R^2	0.3424	0.3846	0.2790
Number of Observations	2277	2119	2279

NOTE: Also included in all regressions are an intercept, controls for SMSA, region, and urban area in 1990, a dummy variable indicating employed part-time, a dummy variable indicating missing type of college, age in 1979, and dummies for parents' occupations. The excluded group from the race dummies is Not-Black/Not-Hispanic. The base group for the education effects is comprised of high school graduates with no post-secondary education. The base group for parents' education are those with no high school diploma.

Variable definitions are in Table 5.