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EMPLOYMENT WHILE IN COLLEGE, ACADEMIC ACHIEVEMENT AND POST-COLLEGE OUTCOMES: A SUMMARY OF RESULTS

Ronald G. Ehrenberg

Daniel R. Sherman

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ABSTRACT

This paper uses panel data that cover the 1972-1979 period obtained from the National Longitudinal Survey of the High School Class of 1972 to study how male college students' employment while in college influences their academic performance, persistence in school, decisions to enroll in graduate school, and post-college labor market success. The analytic framework employed treats in-school employment as endogenous and determines persistence by a comparison of expected utilities.

Ronald G. Ehrenberg
New York State School of Industrial and Labor Relations
Cornell University
Ithaca, NY 14851-0952

Daniel R. Sherman
Federal Trade Commission
2120 L Street, NW
Washington, DC 20580

I. Introduction

Recent and proposed cutbacks of federal financial aid programs for students attending institutions of higher education have serious implications for these institutions, individual students, and society as a whole. The institutions must rethink how they will allocate their relatively scarce institutional scholarship resources in the face of increasing student need.[1] Financial aid packages have, and will, increasingly become more heavily weighted toward loans and in-school employment. These changes will affect students' decisions to enroll in higher educational institutions, their choices of colleges, the loan burdens to finance education they assume, and their part-time employment levels while enrolled in college.

Society as a whole should be concerned about how these latter decisions affect a number of educational and labor market outcomes. Will increased employment while enrolled in college affect students' college academic performance either positively or negatively? How does such employment and academic performance influence subsequent labor market success? How will the increased loan burdens associated with college attendance affect decisions to pursue post-graduate education and/or the occupational choices of college graduates?

This paper addresses some of these issues, using panel data that cover the 1972-1979 period obtained from the National Longitudinal Survey of the High School Class of 1972 (NLS72).[2] It provides evidence on the effects of employment while in college on students' academic performance, persistence in school, decisions to enroll in graduate school, and post-college labor market success A large literature, primarily by noneconomists, has previously addressed the issue of how work experience while in college affects academic performance and persistence.[3] This literature is not completely satisfactory in that it fails to control for the possibilities that such employment is determined simultaneously with choice of college and that persistence in college is at least partially determined by a comparison of the earnings streams an individual could expect to realize if he continued on in, or dropped out of, college.[4] Our research considers both of these problems.

The plan of the paper is as follows. Section II provides our analytic framework. Section III describes the data used in the analyses, while the following three sections summarize our empirical results. Finally, Section VII presents some concluding remarks and indicates directions for future research.

II. Analytic Framework

Based upon a simple static family utility-maximization model, that is sketched in the appendix, of the choice of college quality, student employment while in college, expected academic performance, and expected post-college earnings, one can obtain that

(1a) $t_w = t_w(X_1)$

(1b) $Q = Q(X_1)$

(1c) $A = A(Z,Q,t_w)$ $\quad A_1 > 0,\ A_2 < 0,\ A_3 < 0$

(1d) $WP = WP(Z,A,Q,t_w)$ $\quad WP_1 > 0,\ WP_2 > 0,\ WP_3 > 0,\ WP_4 > 0$

Here t_w is the time an individual is employed while in college, Q is the quality of the college he attends, A is his expected academic achievement while in college, WP is his expected post-college wage, Z is a measure of the student's ability and X_1 is a vector of family and student background variables (e.g., student ability, family income, family size) that influence both the choice of college quality and the time the student is employed while in college. Equation (1c) can be thought of as an academic achievement production function; presumably the less time spent working the more time the student will have to study and the better he will do in college. Similarly, equation (1d) can be thought of as an expected post-college earnings equation. To the extent that employment while enrolled in college helps develop work habits or merely signals other attributes (such as high motivation) that make potential employees more attractive to employers, expected post-college wages will be positively related to hours worked while enrolled in college.

The focus of our attention is equations (1c) and (1d). However, estimation of (1a) and (1b) provides instruments for hours of work and college quality that are used by us below to test whether treating these variables as endogenous alters estimates of the effects of work while in college on grade point averages and post-college earnings.

Unfortunately, although a recursive model, the system specified in (1) ignores the sequential nature of the decisions being made. Specifically, each year students make decisions on how many hours to work if they continue in school and whether to continue in school (persist) or to drop out, all conditional upon their prior academic performance, changing economic and family considerations, and their expectations about the future. Hence, the above research strategy must be modified. The approach we follow is described below.

First, we estimate equations (1a)-(1c) to ascertain the effect of freshman year hours of work on freshman year grade point averages. Given an individual's grade point average in his freshman year, we then ask what the probability is that the individual continues on (persists) in college the next year? Presumably an individual makes such a decision based on a comparison of his utility if he remains in college, V_S, with his utility, V_D, if he drops out. We take the former to be a function of the student's academic achievement to date (A), his expected future earnings if he remains in college (W_{PS}), his employment hours while in college (a measure of the consumption value the student gets from education), a vector of variables that reflect his family's economic circumstance (X_2) and random factors (ε_S). Similarly, his utility from dropping out is assumed to depend upon academic achievement, the variables that reflect economic circumstances, his expected future earnings if he drops out (W_{PD}), and random factors (ε_d).

For ease of exposition, suppose V_S and V_D may be written

$$(2a)\quad V_S = \gamma_{0S} + \gamma_{1S}A + \gamma_{2S}W_{PS} + \gamma_{3S}t_w + \gamma_{4S}X_2 + \varepsilon_S \qquad \gamma_{1S}, \gamma_{2S}, \gamma_{3S} < 0$$

$$(2b)\quad V_D = \gamma_{0D} + \gamma_{1D}A + \gamma_{2D}W_{PD} + \gamma_{4D}X_2 + \varepsilon_D \qquad \gamma_{2D} > 0.$$

Then we may specify that the individual's net utility from persisting in school is given by the unobservable variable L,

$$(3a)\quad L = V_S - V_D = (\gamma_{0S}-\gamma_{0D}) + (\gamma_{1S}-\gamma_{1D})A + (\gamma_{3S})t_w$$
$$+ (\gamma_{4S}-\gamma_{4D})X_2 + \gamma_{2S}W_{PS} - \gamma_{2D}W_{PD} + (\varepsilon_S-\varepsilon_D).$$

Without loss of generality, suppose that

$$(3b)\quad \begin{aligned} d &= 1 \text{ if } L \geq 0 \quad \text{(individual persisted in school)} \\ &= 0 \text{ otherwise} \quad \text{(individual did } \underline{\text{not}} \text{ persist in school).} \end{aligned}$$

That is (3a) and (3b) together represent a <u>structural</u> persistence model--a probit model if the error terms in (3) are assumed to be normally distributed.

To estimate (3) one requires data on W_{PS} and W_{PD}. While we have proxies for the former for individuals who persisted in college each year and proxies for the latter for those who did not continue in college each year, we do not have measures of both for any given individual. It is natural to try to obtain estimates of these variables, based on the proxies, by estimating

$$(4a)\quad \log W_{PS} = \alpha_S' X_{3s} + u_s$$

for the sample of individuals who persist and

(4b) $\log W_{PD} = \alpha_D' X_{3d} + u_d$

for the sample of individuals who do not persist, where X_3 represents the vector of variables expected to influence future earnings (from (1d)) in both "sectors" and u_s and u_d are random error terms. Given the estimated vectors of coefficient, $\hat{\alpha}_S'$ and $\hat{\alpha}_D'$, we can then obtain estimates for any individual i of the expected values of both earnings streams from

(5) $\log \hat{W}_{Pdi} = \hat{\alpha}_d' X_{3i}$ and $\log \hat{W}_{Psi} = \hat{\alpha}_s' X_{3i}$

As is well known, estimation of (4a) by OLS on the sample of persisters and of (4b) by OLS on the sample of nonpersisters may lead to biased estimates of the 's; we may confound the effect of a variable on expected future earnings for each group with its effect on the group in which the individual is located. However, if the error terms in (3) and (4) are assumed to be jointly normally distributed, then the two-stage procedure first suggested by James Heckman (1979) and Lung Fei-Lee (1978) can be used to obtain consistent estimates of the α's.

Briefly this involves our substituting (4) into (3) and then estimating a reduced form probit persistence model that includes A, t_w, X_2 and X_3 as explanatory variables. These estimates can be used to obtain estimates of the inverse Mills ratio which in turn can be added to (4) as an additional explanatory variable. Estimation of these augmented equations by OLS then yields consistent estimates of the $\hat{\alpha}$ for each sample. These in turn can be used with (5) to obtain consistent estimates of $\log W_{Pd}$ and $\log W_{Ps}$ for each individual, which in turn permits estimation of the structural persistence equation (3).

Once this process is completed, we move to the estimation of hours of work and grade point average equations for those enrolled in the second year of the sample, contingent on their behavior in the first year. This in turn leads to subsequent estimation of second year persistence equations and the process is repeated. For students initially enrolled in 2-year colleges, we terminate the estimation after two academic years, while for those initially enrolled in 4-year colleges, we terminate the estimation after four academic years. In both samples, we also estimate how hours of work have influenced graduation probabilities for those who persisted in college up to our termination dates and, for the 4-year sample, the probability of enrollment in post-graduate education.[5]

III. Data

Our analyses use data from the NLS72, a national sample of about 23,000 high school seniors conducted in 1971-72, with follow-up surveys in the falls of 1973, 1974, 1976 and 1979. We restricted our analyses to male students who had graduated high school by October of 1972, who were present in the first follow-up survey and enrolled full-time in either a 2-or 4-year academic program in October of 1972, and who reported both their grade point average for the 1972-73 academic year and their hours of work in October of 1972.[6] This left us with an initial sample of some 2,700 individuals, about 2,000 of whom were enrolled in 4-year colleges.

Table 1 provides descriptive statistics on the October 1972 freshman year hours of work for these students, as well as similar data for those of them still enrolled in 2-year colleges in October of 1973 and enrolled in 4-year colleges in October of 1973, 1974 and 1975. While less than one-third of the 4-year students were employed in October of 1972, over half of the 2-year students were employed, with mean weekly hours of work among those working being

21.3 and 25.8, respectively. In succeeding years both the fraction of continuing students who were employed and the mean weekly hours of those who worked increased.

Most of the variables used in our analyses come directly from the NLS72 data file. The quality of the 4-year college a student attends is measured by the sum of the average math and verbal SAT scores of entering freshmen at the student's college in 1972 and these data were obtained from Cass and Birnbaum (1972). In cases where SAT scores were not available for freshmen at a college, the mean SAT score for colleges with a similar Cass and Birnbaum selectivity index was used.[7]

Two key variables in the analyses each year are the expected future earnings streams if an individual persists in school and if he drops out. Since the data set we have only runs through 1979 and provides at most three years information on earnings for individuals who ultimately graduated from 4-year colleges, estimates of these streams must be based on truncated flows. This obviously induces measurement error into their calculations. These earnings streams are proxied by an individual's average annual earnings during calendar years 1977, 1978 and 1979, and by his average weekly earnings during October of those years.

When estimating equation (4), we include only individuals who report positive earnings levels in all three years in the sample. Thus, we exclude individuals who are unemployed or out of the labor force in any year during the period and those who are enrolled in undergraduate or graduate or professional schools during the period. These restrictions may cause us to overstate the expected earnings of drop outs (who are likely to be more frequently unemployed than persisters) and to understate the expected earnings of persisters (who are likely to be more frequently enrolled in post-graduate education than drop-outs). These problems, plus the problem that we only have access to at most three years' earnings data for 4-year college graduates, decrease the likelihood that we will find future earnings to be an important explanatory variable in the structural probit models.

IV. Grade Point Average Equations[8]

Table 2 presents estimates of the marginal effects of a student's hours of employment in October of each year on his grade point average (GPA) that year.[9] The NLS data enable us to focus on the 1972-73 GPA, the 1973-74 GPA, and the 1974-76 GPA; the latter for both students who attended college only in 1974-75 and for those who attended in both 1974-75 and 1975-76. The data also permit us to distinguish whether the student was employed on-campus or off-campus in October of 1974 and 1975, hence we can estimate if there are differential effects of on-campus or off-campus work in those years.

In each case, the student's grade point average on a linear scale with A set equal to 4 and D set equal to 1, was specified to be a linear function of his hours of employment, as well as a vector of control variables.[10] For the 1972-73 GPA equation, the latter included variables to capture the student's high school GPA, rank in class, hours of work while in high-school, involvement in other high school activities, family background, high school curriculum, SAT scores, and the quality of the college being attended (for students at 4-year colleges).[11] For the latter two GPA's, only the prior year's GPA and the quality of the college were included.

Column (1) for each sample includes both actual hours of work and an instrument for hours of work; the latter obtained in each case from a Tobit reduced form weekly hours of employment equation (e.g., equation (1a)). The latter variable is never statistically significant, which suggests that we can legitimately treat hours of work as exogenous in these grade point average equations.[12]

Column (2) for each sample contains the hours equations when only actual hours of work are included. In these students' freshman year (1972-73), actual hours of work in October of 1972 is seen to have a negative influence on grades of 2-year college students but not to influence grades of 4-year students. However, even in the former case the effect is small. For example, a 2-year college student who worked 25 hours per week would be predicted to have a grade point average that was 0.1 lower than that of a student who did not work at all; this should be contrasted to the mean first-year GPA of roughly 2.6 in the sample. Moreover, as the table indicates. neither predicted nor actual hours of work in October of 1973 are seen to affect the 1973-74 GPA.[13]

The bottom panel of Table 2 presents estimates of the effects of hours of work in October of 1974 and 1975 on 4-year students' grade point averages during the 1974-76 period. The NLS72 did not survey students in the fall of 1975 and, while retrospective questions on fall 1975 hours of work were asked in later surveys, grade point average data were not collected separately for the 1974-75 and 1975-76 academic years. Rather, students reported their grade point averages for the entire two-year period. As a result, we analyze the third and fourth years' data together. Estimates are presented of the effect of all hours of employment, of on-campus hours, and of off-campus hours of work. Separate estimates are presented for those students enrolled only in 1974-75 and those enrolled in both 1974-75 and 1975-76.

Given the small sample sizes in the former case, we focus our discussion on the latter. The results in the bottom panel of Table 2 suggest that hours of work can be treated as exogenous in the grade point average equations (predicted hours are never significant) and that only hours of work off-campus affect grade point averages. However, the marginal effect of off-campus hours in the junior year (positive) just offsets the marginal effect of off-campus hours in the senior year (negative), so if a student worked the same number of hours in both years the net effect on his grade point average was zero.[14]

In sum, we do not find any strong evidence for this national sample of college students that hours of work during the academic year in the range that students worked significantly (both in a statistical and a quantitative sense) reduced grade point averages.

V. Post-College Earnings

As described above, "selectivity corrected" expected future earnings equations were estimated, with the logarithms of average annual and average weekly earnings over the 1977-79 period used as expected future earnings measures. Separate equations were estimated for individuals enrolled in college one year who persisted in college the next year and for those enrolled one year who dropped out the next year. Estimates were obtained for six samples; 2-year college students enrolled in 1972-73, 2-year college students still enrolled in 1973-74, 4-year college students enrolled in 1972-73, 4-year college students still enrolled in 1973-74, 4-year college students still enrolled in 1974-75, and 4-year college students still enrolled in 1975-76.

In each case, expected future earnings were specified to be a function of the student's grade point average in the year, college quality (for students at 4-year colleges), the student's SAT score, whether he had any health limitations, whether English was his primary language, whether he resided in a rural area, four race dummy variables, the unemployment rate and average hourly earnings in the state in which he resided, and his weekly hours of work in October of the year. These equations also included estimates of the inverse

Mills ratio, obtained from reduced form probit drop-out equation estimates for each sample.[15] A complete enumeration of the variables in these latter equations is found in Ehrenberg and Sherman (1985).

In general, the explanatory power of these models was not high. We did find evidence, however, that higher grade point averages led to higher expected future earnings for individuals who persisted in college in each year. Similarly, attendance at higher quality colleges in 1974-75 and 1975-76 led to higher expected earnings for 4-year college students who persisted in college in those years. In contrast, we failed to find any relationship between hours of work while in college and expected future earnings for any of the groups.

VI. Probability of Dropping Out, Probability of "Graduating-on-Time", Probability of Enrolling in Graduate School

Given the expected future earnings equations of the last section, we can impute consistent estimates of expected future earnings for each enrolled student in each year if he drops out and if he persists in college. These in turn can be entered into the structural probit persistence equation (equation 3) and these probit equations estimated. In addition to the expected earnings variables these equations include the student's weekly hours of work in October of the academic year, a group of variables that control for his academic ability and his grade point average to date, variables reflecting his family's economic circumstances, and a vector of race dummy variables.[16]

Table 3 contains the coefficients of hours of employment from the various probit drop-out equations. Also included in this table are hours coefficients from reduce form probit models that sought to explain whether 2-year college students in the sample enrolled in 1973-74 graduated by the fall of 1974, whether 4-year college students in the sample enrolled in 1975-76 graduated by the fall of 1976, and whether 4-year college students, who graduated by the fall of 1976, were enrolled in graduate or professional school at that time. Some of the implications of these coefficients (and the other coefficients in the underlying models) are found in Table 4 where we tabulate the implied marginal effects of working 20 hours/week while in college on drop-out, "graduate-on-time", and enrollment in graduate school probabilities.

Turning first to the freshman year results (columns (1) and (4) of Table 3), longer hours of work are associated with higher drop-out probabilities for both 2-year and 4-year college students. The implied marginal effects of increased hours of work on the probability of dropping out can be computed in a straightforward manner, with the estimates for 2-year students taking into account the indirect effect of hours of work that operates through its effect on grade point averages (see Table 2). Evaluated at the mean value of all explanatory variables in the sample, save for hours of work and grade point average, an additional 10 hours per week of work is associated with a 3 (at 0 hours) to 4.5 (at 40 hours) percentage point increase for 2-year students and a 1.5(at 0 hours) to 2.2 (at 40 hours) percentage point increase for 4-year students.[17] A 2-year (4-year) college student who worked 20 hours a week in his freshman year would increase his probability of not returning for his sophomore year relative to that for a student who did not work at all by 6.6 (3.2) percentage points, ceteris paribus. This should be contrasted with first-year drop-out rates of about 23 percent and 12 percent, respectively, for the 2-year and 4-year college students in the sample (Table 4).

Turning next to the second year results (columns 2 and 5 of Table 3), they indicate that increased hours of work in the second year again led to higher drop-out probabilities for both 2-year and 4-year students. Indeed, evaluated at the mean value of all explanatory variables, the estimates suggest that a 2-year (4-year) college student who worked 20 hours a week would have a probability of dropping out after his second year that was some 7.3 (3.4) percentage points higher than that for a student who didn't work at all. These numbers should be contrasted with second-year drop-out rates of roughly 26 percent (13 percent) for the 2-year (4-year) college students in the sample. Furthermore, the hours coefficient in the 2-year college graduation (by the fall of 1974) equation indicates that longer hours of work clearly reduced the rate at which nondrop-outs graduate "on time". Only one-third of the persisters in 2-year colleges had graduated by the fall of 1974 and, by increasing the length of time it takes 2-year students to graduate, longer hours of work have an additional cost to the students.

Finally, we turn to the results for the third and fourth years, 1974-75 and 1975-76, for 4-year college students (columns 6-9 of Table 3). For these years the NLS reported whether employed students worked on- or off-campus and we test for possible differential effects of the two types of employment. The drop-out equation coefficients suggest that off-campus, but <u>not</u> on-campus, hours of work were positively associated with drop-out probabilities in both the third (junior) and fourth (senior) years.[18] Ceteris paribus, a student who worked 20 hours a week off-campus in his junior (senior) year had a probability of dropping out of college that was about 3.0 (4.5) percentage points higher than a student who didn't work at all that year. These numbers should be contrasted with the drop-out rate in the sample of 9.3 (12.8) percent after the third (fourth) year. Similarly, while weekly hours of work off-campus adversely affected "graduation-on-time" probabilities, on-campus hours did not. Ceteris paribus, a student who worked 20 hours a week off-campus in October of 1975 had an 8.7 percentage point lower probability of graduating by October of 1976 than did a student who did not work at all. This should be contrasted with the overall graduation rate (by October of 1976) of 66.0 percent for the sample of those enrolled in October of 1975. Since the marginal effect of off-campus work hours on the graduation rate was greater than its marginal effect on the drop out rate, working off-campus must also have increased the length of time it took some persisters to get their degrees.

In contrast, for students who had graduated by the fall of 1976, increased on-campus hours of work in their senior year, but not off-campus hours, were associated with a significantly higher probability of their being enrolled in post-graduate education. Indeed, if a student worked 20 hours a week on campus in his senior year, his probability of attending graduate or professional school was 11.0 percentage points higher than that of students who didn't work at all on-campus. This should be contrasted with the overall probability of post-graduate enrollment of 20.3 percent in the subsample of graduates.

It is difficult to know exactly what this latter result implies. On the one hand, we know from the data that individuals who worked on-campus tended to have higher grade point averages and to be enrolled in higher quality colleges. On the other hand, these variables were controlled for directly in the equations that underlie Tables 3 and 4. It is conceivable that, at least in 1975, many of the students working on-campus were doing so in positions that were career related and/or that increased their interest in post-graduate education.

VII. Concluding Remarks

The analyses we presented in this paper have yielded a number of implications about how hours of work during the academic year affected the academic achievement and post-college outcomes of full-time male students who entered college in the fall of 1972. First, for the most part weekly hours of work in the range that students in this sample worked, typically less than 25 hours a week (Table 1), tended not to adversely affect their grade point averages. The only exception was for two-year college students in their freshman year and even here the effect was quantitatively very small.

Second, weekly hours of work in this range did have an adverse effect each year on the probability that a student would be enrolled in school the next year and, for those who did persist, reduced their probability of graduating on time. Since we found no evidence that working while in college increased future earnings for drop-outs or persisters, these adverse effects of hours of work must result either from hours of work reducing the student's perceptions of the consumption value of college or its reducing the number of courses they feel they can handle each year. Either of these changes would reduce their net utility from remaining in college.

Third, when the data permitted us to distinguish whether students worked on-campus or off-campus, only the latter was shown to adversely affect persistence (a result also found by Astin (1975)) and graduation-on-time probabilities. In contrast, working on-campus was associated with a higher probability of enrolling in post-graduate education.

Fourth, although hours of work while in college did not directly affect post-college earnings (they did indirectly through their affect on persistence), students' grade point averages did appear to be important, especially for persisters. Moreover, there was some evidence that college quality also mattered, at least for people who reached their junior or senior year in college.

We must stress, of course, that our results were for a cohort of students who entered college over a decade ago, most of whom worked less than 25 hours a week. Although we found no systematic nonlinear effects of hours in the persistence equations, our results did suggest that the marginal effect of hours worked on drop out probabilities increased with hours worked.[19] Hence, if the same model continues to hold today, longer work weeks for current students caused by increased college costs but less than proportionate increases in financial aid, should lead to greater than proportionate increases in their drop out rates. To verify this it would be prudent to reestimate our models using data for a later cohort of students.[21]

Several limitations of our analyses should also be stressed. First, given the length of the longer paper that underlies this paper, we made no attempts to see if the effects of employment while in college vary with the quality of students, their race, or the quality of the colleges they attend. Clearly such an extension is worth pursuing.

Second, as pointed out by the referees, the associations we observe between drop-out probabilities and hours of work while in college may be confounded by omitted variables that affect both variables simultaneously. While we have tried to minimize these problems by using rather comprehensive specifications of hours of work and drop-out equations, an alternative approach would be to try to estimate a fixed-effects type model directly.

Third, our post-college earnings data were limited to at most three years for 4-year college graduates and this limitation forced us to exclude people enrolled in post-graduate education from our earnings analyses. This led to considerable measurement error in the expected future earnings variables and, not surprisingly, they never proved significant in the probit persistence equations. It would be desirable to redo the analyses using a longer time horizon; data now available from a later wave of the NLS72 data would facilitate this.

Finally, our analyses ignored the effects of loan burdens students assume to finance education on drop out probabilities, occupational choice, the choice of college major, and the decision to enroll in post-graduate education. Only a small fraction of the students in our sample reported total educational loan burdens in any year that exceeded $5,000, so this omission may not have been a serious one for our sample. Yet we know that the loan burdens students are assuming today are substantially higher, especially as they try to limit employment while in college to a "reasonable" level. Analyses of more recent data clearly must address the issues these loan burdens raise.

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Footnotes

1. See Ronald Ehrenberg and Daniel Sherman (1984) for one approach.

2. See John Riccobono, et al. (1981) for a description of the data.

3. See, for example, Alexander Astin's (1975) major study of "drop outs" and R.A. Aposal and C.A. Doherty (1972), J.D. Barnes and R. Keene (1974), J.E. Hay and C.A. Lindsay (1969), J.B. Henry (1967), H.E. Kaiser and G.P. Bergen (1968), and D.J. Trueblood (1957). Many of these studies are summarized in A. Hood and C. Maplethorpe (1980).

4. Gee San (1984) does explicitly model the persistence decision in an economic framework.

5. The issue of when to terminate the estimation is difficult; it is well-known that many individuals who ultimately complete 2- or 4-year colleges take considerably longer than the normal length of the program (see e.g., Manski and Wise (1984). Indeed, in the sample we use in our analyses (described below) less than 25 percent of the students enrolled in 2-year colleges in both 10/72 and 10/73 had received a 2-year degree by 10/74. The limits we choose, while somewhat arbitrary, do have the advantage of reflecting expected (in some sense) normal progress in school.

6. The restriction to males is done to keep the sample as homogeneous as possible. The restriction to students enrolled in 2- or 4-year academic programs creates obvious selectivity problems; we ignore the effect of financial aid and other variables on the decision to enroll in college. There is a large literature on this question, see for example, Charles Manski and David Wise (1983).

7. This index runs from 1 to 8 with lower scores indicating more selective institutions. Over 50 percent of 4-year colleges were in category 8.

8. The next three sections summarize extensive empirical analyses and focus solely on the effects of hours of employment while in college. More completed discussions and coefficients of all of the variables included in each model are found in Ehrenberg and Sherman (1985).

9. Data on weeks worked during the year was also available. Since some weeks worked occur during summer and vacation periods, weekly hours in October (at the start of the academic year) is probably a better measure of students' work effort while enrolled in school.

10. We also experimented with various nonlinear forms of the hours variable but found no consistent nonlinear patterns, either here or in any of the results that are discussed in the next two sections. See Ronald Ehrenberg (1984).

11. High school grade point average (GPA), rank in class, and SAT scores were not reported for some students in the sample. All students, however, reported scores on a battery of standardized tests. GPA, rank in class and SAT scores were imputed for nonreporters based on a regression for reporters of these variables on the battery of test scores.

12. This test for exogeneity, or more precisely the lack of correlation between the error terms in the hours and GPA equations is a variant of the test first proposed by D.M. Wu (1973, 1974). We also allowed for the endogeneity of college quality (Q) in the GPA equation. in this case the Wu test proved inconclusive and the coefficient of $\hat{Q}$ was opposite in sign to that of Q. However, the inclusion of the endogenous quality measure never changed the coefficient of the hours variable in the GPA equation.

13. Experimentation indicated that October 1972 hours of work also never directly influenced 1973-74 GPAs, although they did indirectly for 2-year college students through their affect on 1972-73 GPAs, which in turn affected the 1973-74 GPA. This indirect effect of freshman hours was

exceedingly small, however. For example, working 25 hours per week in the first year would decrease second-year grades of two-year students by -.06 points relative to the grades of students who did not work at all.

14. Table 1 suggests that average hours of work for those working were equal in the two years, although the fraction working increased.

15. Although we call these "drop out" equations, as first noted by Astin (1975), they might better be called "stop out" equations. Some students who do not persist in a year reenter college after a year or two away and ultimately graduate. See also, Manski and Wise (1983) on this point.

16. A more precise description of the variables in each year's drop-out equations, as well as complete tables of results, is found in Ehrenberg and Sherman (1985).

17. Given the mean values of the other explanatory variables, an estimated grade point average is used based on the graade point average equations and the assumed value of hours of work.

18. Note that the point estimate of the on-campus hours coefficient in the first drop out equation, while statistically insignificant, is in fact roughly equal to the on-campus hours coefficient.

19. For example, the following table summarizes the marginal effects of an additional 10 hours of work per week on drop out probabilities for 4-year college students who were initially working either 0 or 40 hours/week (the third and fourth year numbers are for students working off-campus):

	0	40		0	40
First year	1.5%	2.2%	Third Year	1.4%	2.2%
Second Year	1.6	2.7	Fourth Year	2.1	3.5

20. One potential data source is the High School and Beyond Survey, a federally funded longitudinal sample of students, some of whom were in their senior year in 1980.

Table 1

Distribution of Hours of Work for Enrolled Students in the Sample, October of Each Year

	Total Sample	0 Hours	1-15 Hours	16-25 Hours	26+ Hours	%0 Hours	Mean Hours For Those Who Work
2-Year College							
1972	709	305	79	164	161	43	25.8
1973	535	196	66	127	148	36	26.8
4-Year College							
1972	1,993	1,404	208	217	164	70	21.3
1973	1,735	1,066	252	196	228	61	22.6
1974	1,529	904	233	200	202	59	23.1
1975	1,359	693	209	247	210	51	23.0

Source: Authors' computations from the NLS72 data.

Table 2

Estimated Marginal Effects of Hours of Employment on Grade Point Averages
(absolute value of t statistics)

	1972-73 Grade Point Average[a]				1973-74 Grade Point Average[b]			
	2-Year Colleges (n=695)		4-Year Colleges (n=1933)		2-Year Colleges (n=462)		4-Year Colleges (n=1526)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
H72	-.004 (2.5)	-.004 (2.7)	-.001 (0.7)	-.001 (0.8)				
$\hat{H}72$	-.005 (0.7)		-.002 (0.2)					
H73					.001 (0.7)	.000 (0.0)	-.000 (0.2)	-.000 (0.2)
$\hat{H}73$					-.002 (1.0)		.000 (0.1)	

	1974-76 Grade Point Average[c] 4-Year College Students Attend Only in 1974-75 (n=117)		1974-76 Grade Point Average[c] 4-Year College Students Attend in Both Years (n=1186)	
	(1)	(2)	(1)	(2)
Any Employment				
H74	.001 (0.3)	.000 (0.1)	.002 (1.5)	.001 (1.4)
$\hat{H}74$	.014 (1.1)		.002 (0.7)	
H75			-.001 (1.3)	.001 (1.3)
$\hat{H}75$			.006 (1.5)	
On-Campus Employment				
H74	-.011 (1.6)	-.102 (1.8)	.001 (0.6)	.001 (0.6)
$\hat{H}74$	.105 (1.4)		.009 (0.9)	
H75			.001 (0.9)	.001 (0.8)
$\hat{H}75$			.003 (0.1)	
Off-Campus Employment				
H74	.003 (0.9)	.002 (0.5)	.002 (1.7)	.002 (1.6)
$\hat{H}74$	-.051 (0.9)		-.003 (0.4)	
H75			-.002 (2.0)	-.001 (1.9)
$\hat{H}75$			.007 (0.8)	

where: Hj = hours worked/week in October of year j

$\hat{H}j$ = predicted hours of work obtained from Tobit hours of work equations and (in the last two years) probit on-campus employment equations

and

[a]Also included in the model were a vector of explanatory variables that controlled for the students' high-school grade point average, rank in class, work while in high school, involvement in other high school activities, family background, high school curriculum, SAT scores, and the quality of the college attended.

[b]Also included in the model were the students' 1972-73 grade point average and the quality of the college attended.

[c]Also included in the model were the students' 1973-74 grade point average and the quality of the college attended. The on-campus and off-campus employment effects were estimated in a single equation (in each case) by interacting hours of employment with on-campus work status.

Table 3

Estimated Marginal Effects of Hours of Employment in "Drop Out", "Graduate-on-Time" and Graduate Enrollment Equations: Probit Coefficients[a] (absolute value of t statistics)

A. Two-Year College Students

	Drop Out After 1972-73 (n=709) (1)	Drop Out After 1973-74 (n=466) (2)	Graduate by Fall 1974 (n=466) (3)
H72	.012 (3.5)		
H73		.012 (2.9)	-.011 (1.9)

B. Four-Year College Students

	Drop Out After 1972-73 (n=1885) (4)	Drop Out After 1973-74 (n=1531) (5)	Drop Out After 1974-75 (n=1361) (6)	Drop Out After 1975-76 (n=1235) (7)	Graduate By Fall 1976 (n=1235) (8)	Enrolled in Graduate School (n=679) (9)
H72	.009 (2.8)					
H73		.011 (3.6)				
H74C			.012 (1.3)			
H74O			.010 (2.6)			
H75C				-.000 (0.1)	-.002 (0.3)	.014 (2.0)
H75O				.012 (3.1)	-.011 (3.6)	-.003 (0.5)

where (1) - 1=not enrolled in 1973-74; 0=enrolled in 1973-74
(2) - 1=enrolled in 1973-74, not graduated by nor enrolled in 1974-75; 0=enrolled in 1973-74, graduated by or enrolled in 1974-75
(3) - 1=graduate by fall of 1974; 0=not graduate by fall of 1974 but enrolled in 1974-75
(4) - 1=not enrolled in 1973-74; 0=enrolled in 1973-74
(5) - 1=enrolled in 1973-74, not enrolled in 1974-75; 0=enrolled in both years
(6) - 1=enrolled in 1974-75, not enrolled in 1975-76; 0=enrolled in both years
(7) - 1=enrolled in 1975-76, not enrolled in 1976-77; 0=enrolled in both years or graduate by 10/76
(8) - 1=enrolled in 1975-76 and graduate by 10/76; 0=not graduate by 10/76
(9) - 1=graduated by 10/76 <u>and</u> enrolled in graduate or professional school; 0=graduated but did not enroll in graduate or professional school

Hj = hours worked/week in October of year j

HjC = hours worked/week in on-campus employment in October of year j

HjO = hours worked/week in off-campus employment in October of year j

and

[a]Other variables included in the equation are described in the text.

Table 4

Implied Marginal Effects on "Drop-Out", "Graduation-on-Time" and Graduate Enrollment Probabilities of Working 20 Hours a Week

Outcome	Marginal Effect of 20 Hours/Week Employment	Mean Probability in the Sample
2-Year College Students		
Drop-Out After First Year	.066	.230
Drop-Out After Second Year	.073	.260
4-Year College Students		
Drop-Out After First Year	.032	.012
Drop-Out After Second Year	.034	.013
Drop-Out After Third Year[a]	.030	.093
Drop-Out After Fourth Year[a]	.045	.128
Graduate by the Fall of 1976[a]	.087	.660
Enrolled in Graduate or Professional School in the Fall of 1976, if Graduated by that Date[b]	.110	.203

[a]Effect of employment in an off-campus job.

[b]Effect of employment in an on-campus job.

Appendix

The Utility Maximization Model

Suppose that the utility function of a family with a college-age child is given by

$$\text{(A1)} \quad U = U[(C,Q,t_w,W_P] \qquad U_1,U_2,U_4 > 0, \qquad U_3 < 0.$$

where C represents parents' consumption, Q the quality of the college that the child attends, t_w the time that the student is employed while in college, and w_p the student's expected post-college earnings stream. Presumably the family derives positive marginal utility from increased consumption, from having the child attend a higher quality institution (both for current consumption and investment reasons), from having the student work fewer hours while in college (which would free up more time for him to study and participate in extracurricular activities), and from higher expected post-college earnings for the student.

Given a student's ability (Z), his achievement in college (A), as measured by objective variables like grades, depends upon the quality of the college attended and the time the student spends on nonemployment activities while enrolled in college. Presumably it is more difficult for a student of given ability to "do well" at a better college and less time spent working provides more time for studying. Hence

$$\text{(A2)} \quad A = A(Z,Q,t_w) \qquad A_1 > 0, \qquad A_2,A_3 < 0,$$

The student's post-college wage is assumed to be related to his ability, academic achievement, quality of college attended, <u>and</u> time spent working while enrolled in college. To the extent that employment while in college helps develop work habits or merely signals other attributes (such as high motivation) that make a potential employee more attractive to employers after graduation from college, post-college wages will be positively related to hours worked while enrolled in college.

$$\text{(A3)} \quad WP = WP(Z,A,Q,t_w) \qquad WP_1,WP_2,WP_3,WP_4 > 0.$$

The family seeks to maximize the utility function (A1), subject to the academic achievement function (A2), expected post-college wage (A3) and a number of other constraints. First, parents' consumption is equal to their total income (Y) minus their contribution to the student's college expenses (X_P).

$$\text{(A4)} \quad C = Y - X_P$$

Second, the total cost of the student's attending college, which is assumed to be an increasing function of the quality of the college (E(Q)), is equal to the sum of the parental contribution, the student's own financial contribution to his education (X_S) and the total (S) of the scholarship from the college, and other public and private sources that he receives.

$$\text{(A5)} \quad E(Q) = X_P + X_S + S$$

Finally the student's own contribution is determined by his wage rate (w) multiplied by the number of hours he works during the summer and academic year (t_w).

$$\text{(A6)} \quad X_S = wt_w$$

With suitable assumptions about the properties of all of the functions in the model, one obtains a general solution to this maximization problem of the form:

(A7) (a) $X_p = X_p(Z,Y,S,w)$

(b) $Q = Q(Z,Y,S,w)$

(c) $t_w = t_w(Z,Y,S,w)$

(d) $A = A(Z,Q,t_w)$

(e) $WP = WP(Z,A,Q,t_w)$.

Equations (A7) represent a recursive model of the "college enrollment-college activity-college outcomes" process. Parental contributions to children's education (X_P), the quality of college the student attends (Q), and the student's employment time (t_w) are simultaneously determined by the student's ability (Z), family income (Y), the subsidy the student receives for attending college (S) and his wage rate while in school (w). Ability, quality of college and student employment time then affect academic achievement (A) through the educational production function specified in (A7d). Finally, the earnings equation in (A7e) generates post-college earnings (WP) as a function of ability, academic achievement, quality of college, and time devoted to nonemployment activities while enrolled in college.

Unfortunately, this system cannot be directly used as the basis for our empirical work for a number of reasons. First, the assumption that college cost is an increasing function of college quality is difficult to justify, given the coexistence of high-cost private and low-cost public institutions.[A1] Indeed, the whole issue of student choice of public vs. private institution is beyond the scope of this paper.[A2]

Second, the subsidy or scholarship that a student receives from a college is endogenously determined and depends upon factors like the student's ability, the quality and costs of the college, the student's family size and income, and federal financial aid policies. Although one can attempt to explicitly model the scholarship level and embed it in the complete model, to do so requires one to make either somewhat arbitrary variable exclusion, functional form, or stochastic assumptions.[A3]

These concerns suggest that the following modified model be employed. Suppose that we can write the equation for the scholarship received by the student in a year as

$$\text{(A8)} \quad S = S(Z,Q,C,Y\ ,X_4)$$

where C represents the cost of attending the college, and X_4 any other exogenous variables (e.g., family size and race) that might affect financial aid offers.[A4]

One can solve (A7b), (A7c) and (A8) eliminating S, to get reduced form hours of employment and quality of college attended equations[A5]

$$\text{(A9)} \quad \text{(a)}\ t_n = t_n(z\ )$$

$$\text{(b)}\ Q = Q(z)$$

where z now represents all of the exogenous variables implicit or explicit in (A7) and (A8). Equations (A7d), (A7e), and (A9) yield equation (1) in the text.

Appendix Notes

A1. However, if one restricts the analyses to private colleges, one does obtain a strong positive relationship between a college's tuition and its quality; the latter measured by the Cass and Birnbaum (1972) selectivity index for colleges.

A2. See Sherman (1985) for a treatment of this issue.

A3. Charles Manski and David Wise (1983) and Winship Fuller, Manski, and Wise (1982) present attempts to include an endogenous scholarship level in models of college choice.

A4. Presumably parameters of federal financial aid programs also should enter into (A8), however at a point in time these do not vary across individuals or institutions, and so can be eliminated from cross-section analyses without loss of generality.

A5. Since the cost of the college the student attends is also endogenous and presumably determined by the exogenous variables that appear in (A7), C is also eliminated from (A9).