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This study was initiated by the late John Melder as part of his proposed Ph.D. dissertation at the University of Wisconsin and was completed by Sandra Christensen and Burton A. Weisbrod at that University. Christensen is now Assistant Professor of Economics at the University of Maryland and Weisbrod is Professor of Economics and of Educational Policy Studies and a senior staff member of the Institute for Research on Poverty, University of Wisconsin. This study was supported by funds granted to the Institute for Research on Poverty at the University of Wisconsin-Madison, by the Office of Economic Opportunity pursuant to the Economic Opportunity Act of 1964; by the University of Wisconsin Center for Vocational and Technical Education; and by the Computer Science Center at the University of Maryland. The opinions expressed are those of the authors.

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## ABSTRACT

The primary intent of this paper is to separate out the influences of parental income, occupation, and education level on the probability that high school graduates will attend college. The influence of the student's achievement in high school and the presence of a nearby college are also considered. For both males and famales, high school class rank is an important determinant of college attendance, while the presence of a nearby college affects significantly only the female's decision. The family socioeconomic status affects the decision of females considerably more than males. Per capita family income and educational level of the father are the only two components of socioeconomic status that affect males' college-going decisions, although the impact of the income level is small. For females, family income (per capita) has no significant influence on college-going, but educational level of parents and father's occupation are strong influences. The interpretation seems to be that if the male can meet the entrance requirements and pay the matriculation fees, he is likely to attend college. He is almost impervious to parental or community influences. The probability that the female will attend college, however, is strongly affected by parental and community influences.

# Factors Affecting College Attendance

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## Introduction

This paper is an addition to the empirical studies of the variables that influence whether high school graduates go on to post-secondary education. (See Baird; Medsker and Trent; Morgan, David, Cohen and Brazier; Panke.) Our primary interest is in separating out the influences of parental income, occupation, and education level -- variables which often have been subsumed in a single variable denoted as "socioeconomic status." In addition, we allow for the influences of the student's high school achievement and the presence of a nearby public college. Males and females are treated separately in the analysis.

## The Model

The variable we seek to explain is binary. It takes a value of one if the student obtained one or more years of college-level education during the four years immediately after graduation from high school. Otherwise its value is zero. We assume that the decision to go to college is subject to three major influences: the student's "ability," the availability of a low-cost college facility, and the socioeconomic status of his parents. Because our dependent variable is dichotomous, we have chosen to use the maximum likelihood estimation method of Probit analysis. The procedures for estimation and testing of hypotheses in a Probit model are described by Tobin (1955). The model assumes an index I, which is a linear combination of the explanatory variables that determine whether the student attends college or not.

In effect, the model can be viewed as a multiple regression equation in which the estimated dependent variable is an index that can be converted into a probability. The actual value of the index for the $i^{th}$ student is $I_i$, determined by evaluating the linear combination I for the values of the explanatory variables that obtain for the $i^{th}$ student. $\bar{I}_i$ is the critical value of the $i^{th}$ student. If the actual values of the index $I_i$ exceeds the critical value $\bar{I}_i$, then according to this decision model the student will attend college; if $I_i$ is less than $\bar{I}_i$, he will not attend. Over the population of students the critical values $\bar{I}_i$ are assumed to be normally distributed with mean 0 and standard deviation 1, reflecting random differences in personality and tastes not accounted for by the explanatory variables in the index. For a given value of the index I, the probability of attending college is the value of the cumulative normal distribution function F(I).

The likelihood ratio method is used to test hypotheses on the equation coefficients, singly and jointly. The likelihood ratio $\lambda$ is the ratio of the value of the likelihood function when restrictions on some of the coefficients are imposed, to the value of the likelihood function when the coefficients are unrestricted. When the hypothesis is true, the test statistic, $-2 \log \lambda$, is approximately distributed like chi-square with m degrees of freedom, where m is the number of coefficient restrictions imposed. When the value of only a single coefficient is being restricted, the computational burden of the likelihood ratio method may be avoided by using a test based on the approximate normality of the distribution of maximum likelihood estimates from large samples.

The ratio of the estimated coefficient to its standard error provides a test statistic which is distributed approximately standard normal.

Data

Part of the data used here were collected and analyzed by Robert Fenske (1965). He collected information on ability levels and parental characteristics for 4,088 high school seniors living in selected Wisconsin cities in May of 1963. (A list of the communitites included in the study is presented in Table 1.) The student's level of "ability" was represented by two variables: his class rank in high school and his score on a standardized scholastic aptitude test. The test used was the Henmon-Nelson Self-Administering Test of Mental Ability. The test scores range from a low of 0 to a high of 100. Class rank also ranges from 0 to 100. A value of 90, for example, indicates that the student was ranked above 90 percent of his class.

Of the eight Wisconsin communities included in this study, three have no college facility, public or private. Two of the eight communities have a two-year county college; there is only limited transferability of credits from the county college to a four-year state university. Three of the communities have an extension campus of the state university system, which provides the first two years of college-level education; (one of these three communities also has a 2-year county college) these credits are transferable to a four-year state university. One of the eight communities has a four-year state university. A set of dummy variables is used to represent each distinct type of college facility, enabling us to discern the influence of each type on the college decision.

In the spring of 1967, four years after the original survey, a follow-up study was made by Norman Dufty and Richard W. Whinfield of the University of Wisconsin Center for Studies in Vocational and Technical Education, to determine which of the students originally surveyed had attended college. Subsequently, income data for a random sample of the students' families were obtained by John Melder from the Wisconsin Department of Taxation, for the years from 1959 through 1965. The result was a sample of 440 high school graduates. There are 232 males in the sample; of these, 169 attended college for at least one year in the interval from 1963 to 1967. Of the 208 females in the sample, 158 attended college for at least one year during the same interval. The response rate in the follow-up study was only 46 percent, and it was reported that "the students who were more successful in high school were apt to respond with a higher percentage of responses than students in the lower percentile." (Annual Report, 1970). Indeed, the finding that nearly 75 percent of the respondents went on to college, however briefly, makes clear the response bias. From unpublished work on similar data by William Sewell, however, it appears that the importance of factors influencing whether high-school students go on to college is not affected materially by such a low and biased response.

Previous studies on this subject have often chosen a composite variable to represent the socioeconomic status of the student's family. The composite variable "is based on a weighed combination of father's occupation, father's formal educational level, mother's formal educational level, and. . . the income status of the student's family."

(Sewell-Shah, 1968, p. 562) Sewell and Shah (p. 572) say that "Within the complex which is subsumed under socioeconomic status, the economic resourses available for the support of college education must be an important determinant, and none of the studies reported to date have adequately assessed this aspect of socioeconomic level." We investigate the components of socioeconomic status separately. Total family income per dependent is one of our explanatory variables. Eight occupational categories are entered by a set of dummy variables. Finally, four educational categories for each parent are entered also by sets of dummy variables.

Discussion of the Results

Table 2 presents the estimates obtained for the index function. To reiterate, the influence of the college facility available in the community, the formal educational levels of the student's mother and father, and the occupation of his father are represented by sets of binary variables. The excluded category for the type of community college facility is the one for no local college facility. For the formal educational level of the student's parents, the excluded category is for having completed an eighth grade education or less. The excluded occupational category is the one for unskilled workers. Thus, the value of the constant presented in Table 2 is for an individual who lives in a community with no college facility, whose mother and father have no more than an eighth grade education, and whose father is an unskilled worker.

The likelihood ratio $\lambda$ in the test statistic $-2 \log \lambda$ presented in Table 2 is the ratio of the value of the likelihood function when all of the coefficients other than the constant are restricted to be zero, to the value of the likelihood function when the coefficients are unrestricted.

Thus, the value of $-2 \log \lambda$ provides a test of the hypothesis that the variables we have selected are not significant determinants of the decision to attend college. Given our hypothesis, the probability is less than .01 that the value of $-2 \log \lambda$ would exceed a value of 36.2. Since we have obtained values for the test statistic of 81.6 for males and 87.3 for females, we may reject the hypothesis, for both males and females, that the variables we have selected are not significant determinants of the decision to attend college, where the level of significance is $\alpha = .01$.

The coefficients presented in Table 2 can be used to calculate the estimated probability of attending college, when particular values for the explanatory variables in the index function are assumed. The first column (I) in Table 3 presents the calculated value of the index function for the particular set of explanatory variable values specified; the second column (F(I)) in Table 3 presents the estimated probability of attending college, obtained as the value of the cumulative normal distribition function at I. The calculated probabilities are presented first for males and then for females. The first pair of probabilities -- line 1 -- is calculated for an individual whose class rank and IQ are both 65, who lives in a community where there is a county college, whose mother and father are high school graduates, whose father is a skilled worker, and whose family income per dependent is \$2500. These are, approximately, the model values in the sample. Succeeding pairs of probabilities -- lines 2 through 10 -- are calculated after making the indicated changes in the values assumed for the explanatory variables.

For the typical male in the sample, the estimated probability of attending college is .76; for the typical female, the probability is .83 (Table 3, line 1). The estimates in Table 2, line 2, indicate that class rank in high school is a highly significant influence ($\alpha$= .01) on the college decision, for both males and females. The higher the level of achievement, as evidenced by class ranking, the more probable it is that the student will attend college. Comparison of lines 1 and 2 in Table 3 indicates that an increase of 10 percentage points in class rank above the model value increases the probability that a male will attend college by 7 percentage points; for a female, the probability is increased by 6 percentage points.

Table 2, line 3, shows that for males, IQ is also a significant influence ($\alpha$= .05); from Table 3, lines 2 and 3, we see that a given percentage point increase in IQ is almost as powerful in encouraging college attendance by males as a comparable rise in class rank. Females, however, are less responsive to IQ than to class rank; their estimated coefficient for IQ is not significantly different from zero (Table 2, line 3). One possible explanation for the differential importance of IQ for males and females relies on the validity of using class rank as a measure of achievement, and IQ as a measure of ability. The societal assumption that a female will be a housewife while a male will be the income-earner leads to the presumption that it is highly desireable for a male to attend college, but that college is something of a frill for a female. Thus, many high ability (IQ) females do not attend college. But some females have wider horizons than society ascribes to them. These ambitious females are interested in careers outside the home, and college for them is not a frill. It is a job necessity.

These women are probably high achievers academically. Thus, they would predominate among the females ranked high in class, resulting in the sizable positive relationship between class rank and college attendance for females. For males, the sizable positive relationship between both class rank and IQ on the one hand, and the probability of college attendance on the other is indicative of the pressures operating on the male as a future family bread-winner. If he can meet college entrance requirements, he is likely to attend.

None of the coefficients estimated for the set of dummy variables representing the type of college facility in the community is significantly different from zero, for the male. Thus, the male's college decision does not seem to be strongly influenced by the presence or lack of a college in his community. Since the real cost of attending college is affected by the school's proximity, this finding suggests that the price elasticity of demand for college by males is low.

For the female, however, the presence of either a two-year college or a four-year state university is a significant force ($\alpha$ = .01) in increasing the probability that she will attend college (Table 2, lines 4 and 6). The calculated probabilities presented in Table 3, line 4, indicate that the presence of a four-year state university in the community, rather than a county college, would raise the female's probability of attending college by 11 percentage points. If we instead calculated the change in the probability of attending college by comparing a community with a four-year state university to one with no college facility, the female's probability of attending college would rise by 49 percentage points. (This last result is not shown in Table 3.)

The insignificant influence of a two-year university extension in the community on the female's college decision might be explained by the fact that she must transfer to a four-year university in another community to complete her training. The apparent reluctance of the female to leave her home community suggests a more sizable price elasticity of demand for females than for males.

Our results indicate that the female's college decision is much more responsive to her family's socioeconomic status than the male's decision is. A comparison of the calculated probability of attending college for a student from a family of low socioeconomic status to the probability for a student from a family of high socioeconomic status is presented in Table 3, lines 9 and 10. The probability that a male of low socioeconomic status will attend college is .60; if he were of high socioeconomic status, the probability of his attending college would rise by only 12 percentage points, to .72. But the probability that a female will attend college would rise by 46 percentage points, from .53 to .99. The probabilities calculated separately for each of the components of socioeconomic status (Table 3, lines 5 through 8) indicate that the bulk of the females's response is to the level of her mother's education and to the occupational category of her father.

Chi-square tests were performed to ascertain the significance of the explanatory power added by the component variables of the socioeconomic status complex. We compared the explanatory power of an equation in which none of the components of socioeconomic status entered, to the power of an equation in which only one of the components was entered.

We tested for a significant increase in explanatory power by adding, singly, income per dependent, occupation, father's education, and mother's education. The results of these tests are discussed below, but are not shown in Table 2.

We found that the introduction of the father's educational level significantly increases the explanatory power of the equation, for males ($\alpha = .10$) and for females ($\alpha = .01$). The higher the level of education achieved by the father, ceteris paribus, the greater is the probability that his child will attend college. The introduction of the father's educational level adds a significant amount of explanatory power ($\alpha = .10$) even if the mother's educational level is already included in the equation, for both males and females.

For females, the introduction of the mother's educational level also adds significantly ($\alpha = .01$) to the explanatory power of the equation in which no other socioeconomic status components enter. By contrast, the male's college decision is not responsive to the level of his mother's education; introduction of the mother's educational level into the male's regression equation does not add significantly to its explanatory power.

The occupation of the father is another influence on the college decision which adds significantly to the explanatory power of the regression equation without socioeconomic variables for females ($\alpha = .01$), but not for males. From Table 2, lines 13 through 19, it is seen that females whose fathers are clerical workers are among the least likely to attend college. It might be thought odd that clerical workers would offer less encouragement to their children's college plans than would unskilled workers (the occupational group which serves as the base from which the influence of the other groups is measured).

This can be explained, however, by the fact that clerical skills can be obtained efficiently in a vocational school. If a father who is a clerical worker encourages his daughter to acquire the same skills, he might well encourage her to take the concentrated business course offered by a vocational school, rather than to attend a college where she would be required to take a liberal basic studies course in addition to her courses in business skills.

Unskilled workers, skilled workers, and farmers apparently offer relatively little encouragement to the college plans of their daughters. The workers in these categories probably have had little experience with college themselves; nor would these people be likely to come into frequent contact with others who have obtained college education. Hence, it is plausible that they have little incentive and perhaps inadequate information to encourage their children to attend college.

Sales and service workers appear to offer slightly more encouragement to their daughter's college plans. Though these workers, too, need have no college education, they would, in the course of their work, come into contact with many who are college-educated. They have access to information about the possible advantages offered by a college education and thus have some incentive to encourage their children to attend. Fathers in the professional and managerial groups offer a great deal of encouragement to the college plans of their daughters. Fathers in these groups have probably attended college themselves. They are well aware of the possibilities offered by a college education for more interesting and better-paying jobs than can usually be obtained without college. They might also view the college campus as an ideal place for their daughters to meet a suitable husband.

The influence of income per dependent on the college decision is surprising, for it is the explanation of the male's response which is significantly improved ($\alpha = .05$) by the introduction of income as an explanatory variable into the regression equation (not shown) in which no other socioeconomic variables enter; the female's response is not significantly affected by income. This result might be explained in part by the great proclivity of females to attend college only if there is a college facility in their community. This reduces greatly the expense of college attendance, and makes the family's budget constraint less binding. The male's decision to go to college is not so dependent on the presence of a convenient college facility; he decides to go to college on the basis of other influences. This often means attending college outside of his home community. Since the cost of college attendance away from home is high, the family's income situation must be a relevant influence on him. The quantitative impact of income per dependent on the male's college decision, while statistically significant, is nevertheless small. In fact, a rise from, say $2500 to $3500 per dependent results in an imperceptible increase in the male's probability of attending college. And when the influence of other variables is considered, the marginal impact of income (Table 2, line 20) is not statistically significant for either males or females. In short, the partial income elasticity of demand for college education was essentially zero for both males and females.

The income measure used to obtain the estimates in Table 2 was reported family income for 1963, the year in which the members of our sample graduated from high school.

We experimented with several alternative income measures: average yearly income from (1) 1961 to 1963; (2) 1959 to 1963; and (3) 1959 to 1965. It was thought that an average income measure might give a better indication of the permanent income of the family, and that the permanent income of the family was the more appropriate budget constraint. However, it made little difference to our results which income measure we chose. The estimated coefficients were virtually unchanged when any of the alternative measures were used. The explanatory power of the equation using 1963 income was marginally higher than the explanatory power using the alternative measures; consequently we chose to report the equation using the 1963 measure.

Summary of Results

Our estimates indicate that a student's high school class rank is an important determinant of college attendance, for both males and females. For females, the presence of a nearby college facility is also an important influence. The male's response, however, is not significantly affected by this factor.

The composite of family characteristics which determines socioeconomic status is an important influence on the college decision of both males and females, but its influence is considerably greater on females than on males. The level of per capita family income and the educational level of his father are the only two components of socioeconomic status which significantly affect the male's college decision. Furthermore, the quantitative impact of the income variable on his decision is small.

By contrast, the per capita level of family income has no significant influence on the female's college decision, while she is strongly influenced by the remaining components of socioeconomic status -- the educational levels of her parents and the occupation of her father.

The implication seems to be that if the male can meet the entrance requirements and pay the matriculation fees, he is likely to attend college. He is almost impervious to parental or community influences. The probability that the female will attend college, however, is strongly affected by parental and community influences.

Table 1

Availability of College Facilities in Wisconsin Communities Studied

| Wisconsin Communities Studied | College Facilities Available |
|---|---|
| Fond du Lac | no college facility |
| Janesville | no college facility |
| Kenosha | 2-year university extension |
| Manitowoc | 2-year university extension plus 2-year county college |
| Marshfield | no college facility |
| Oshkosh | 4-year state university |
| Racine | 2-year university extension |
| Wisconsin Rapids | 2-year county college |

Table 2

Estimates of the Index Function I

| | Explanatory Variable | Coefficient (and standard error) Male | Female |
|---|---|---|---|
| (1) | Constant | -2.70300 (.73000)[a] | -3.54100 (.87000)[a] |
| (2) | Class rank | .02500 (.00600)[a] | .02800 (.00800)[a] |
| (3) | H-N test score (IQ) | .02100 (.01000)[b] | .01200 (.01000) |
| | Community college facility: (excluded category: no college) | | |
| (4) | county teachers college | -.04800 (.25000) | 1.07300 (.29000)[a] |
| (5) | university extension | -.12000 (.36000) | -.34400 (.49000) |
| (6) | state university | .20100 (.25000) | 1.64800 (.29000)[a] |
| | Education of mother: (excluded category: 8th grade or less) | | |
| (7) | 9th thru 11th grade | -.11300 (.41000) | .64000 (.52000) |
| (8) | high school graduate &/or some college work | -.08700 (.34000) | .32100 (.37000) |
| (9) | college graduate &/or some post-grad work | -.58400 (.56000) | 1.10400 (.66000) |
| | Education of father: (excluded category: 8th grade or less) | | |
| (10) | 9th thru 11th grade | -.11800 (.34000) | .25200 (.43000) |
| (11) | high school graduate &/or some college work | .47500 (.30000) | .44700 (.31000) |
| (12) | college graduate &/or some post-grad work | .62100 (.61000) | .63800 (.78000) |
| | Occupation of father: (excluded category: unskilled laborer) | | |
| (13) | farmer | .08400 (.52000) | .24500 (.54000) |
| (14) | non-farm proprietor or manager | .35900 (.37000) | 1.06300 (.51000)[b] |
| (15) | clerical worker | .25600 (.46000) | -.11100 (.71000) |
| (16) | sales worker | .37200 (.45000) | .29100 (.53000) |
| (17) | skilled laborer | .05300 (.29000) | .14900 (.31000) |
| (18) | professional | .28800 (.58000) | 1.12000 (.71000) |
| (19) | service worker | .95100 (.50000) | .43400 (.86000) |
| (20) | Income per dependent | .00001 (.00008) | -.00004 (.00007) |
| | Number of observations | 232 | 208 |
| | $-2 \log \lambda$ | 81.6 | 87.3 |

[a]significant at $\alpha = .01$

[b]significant at $\alpha = .05$

Table 3

Estimated Probability of Attending College

| | Value of Explanatory Variables | I | | F(I) | |
|---|---|---|---|---|---|
| | | Male | Female | Male | Female |
| (1) | Basic:<br>rank = 65<br>IQ =65<br>county teachers college<br>mother: high school<br>father: high school<br>occupation: skilled<br>income per dependent = $2500 | .705 | .949 | .76 | .83 |
| (2) | Basic, except rank = 75 | .955 | 1.229 | .83 | .89 |
| (3) | Basic, except IQ = 75 | .915 | 1.069 | .82 | .86 |
| (4) | Basic, except state university | .954 | 1.524 | .83 | .94 |
| (5) | Basic, except mother: college | .208 | 1.732 | .58 | .96 |
| (6) | Basic, except father: college | .851 | 1.140 | .80 | .87 |
| (7) | Basic, except occupation: professional | .940 | 1.920 | .83 | .97 |
| (8) | Basic, except income per dependent = $3500 | .715 | .909 | .76 | .82 |
| (9) | Low SES:<br>rank = 65<br>IQ = 65<br>county teachers college<br>mother: 8 yrs or less<br>father: 8 yrs or less<br>occupation: unskilled<br>income per dependent = $1500 | .254 | .072 | .60 | .53 |
| (10) | High SES:<br>rank = 65<br>IQ = 65<br>county teachers college<br>mother: college<br>father: college<br>occupation: professional<br>income per dependent = $3500 | .599 | 2.854 | .72 | .99 |

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