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John H. Bishop
Cornell University

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The Explosion of Female College Attendance

Abstract

[Excerpt] This paper will attempt to determine the extent to which changes in female college attendance over time have been responses to the various factors discussed above. In Section I, a simple model of the college attendance decision is developed which incorporates most of the factors discussed above. Section II presents the results of fitting the specification implied by the theory developed in Section I to data on the college attendance choices of 29,141 women who were high school juniors in 1960. Major findings of this analysis are that female college attendance is very responsive to public decisions about the location of colleges and the level of tuition. A second finding is that the economic payoff to college is also an important determinant of attendance.

Keywords

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THE EXPLOSION OF FEMALE COLLEGE ATTENDANCE

by

John H. Bishop
Cornell University
Center for Advanced Human Resource Studies
School of Industrial and Labor Relations
Ithaca (New York) 14853-3901
(607) 255-2273

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This paper has not undergone formal review or approval of the faculty of the ILR School. It is intended to make results of Center research, conferences, and projects available to others interested in human resource management in preliminary form to encourage discussion and suggestions.

THE EXPLOSION OF FEMALE COLLEGE ATTENDANCE

The postwar period has seen an explosion of college enrollment by women. In 1947 there were only 523,000 women enrolled in college. By 1988 that number was 13.7 times greater, a total of 7,166,000. The proportion of the 18/19 year old women attending college rose from 12.2 percent in 1947, to 34.6 percent in 1970 and 45.8 percent in 1988. Since the high school completion rate has risen during this period from 56 percent to 84 percent, proportions of high school graduates attending college rose somewhat more slowly than ratios of attendance to population. Nevertheless, proportions of 14 to 24 year old female high school graduates attending college nearly doubled from 14.1 percent in 1947 to 26.3 percent in 1970 and then expanded further to 36.8 percent in 1988.¹

What caused this enrollment explosion? Was it primarily a result of rising family incomes and the higher educational levels of the parents of more recent cohorts? Studies of male college attendance have found that enrollment rates are quite sensitive to the size of the salary differential between college and high school graduates (Freeman, 1975). For men, a major share of the postwar increase in college enrollment rates was found to be a response to a rising return to schooling. Did a similar increase in the payoff to college occur for women? Do women respond to the size of the college high school salary differential to the same degree men do? If the answer to both of these questions is yes, the rise of female enrollment rates may slow down for the monetary payoff to the college education of women will probably rise more slowly in the future than it has in the past.

Both time series and cross section studies have found that higher levels of tuition, room and board costs, lower college attendance. (Campbell and Siegel, 1964; Bishop, 1977). A number of cross section studies have found that birth order and number of siblings affect performance on standardized tests and the likelihood of attending college (Zajonc, 1975; Hauser and Featherman, 1976). Zajonc has theorized that rises in the mean parity of the cohort are partly responsible for the decline in SAT scores that has been occurring since the mid 1960s. If fluctuations in national mean SAT scores have been caused by changes in the mean parity of cohorts, it is likely that college attendance rates have responded as well.

This paper will attempt to determine the extent to which changes in female college

attendance over time have been responses to the various factors discussed above. In Section I, a simple model of the college attendance decision is developed which incorporates most of the factors discussed above. Section II presents the results of fitting the specification implied by the theory developed in Section I to data on the college attendance choices of 29,141 women who were high school juniors in 1960. Major findings of this analysis are that female college attendance is very responsive to public decisions about the location of colleges and the level of tuition. A second finding is that the economic payoff to college is also an important determinant of attendance.

In sections III and IV, trends in the payoff to college for women are measured and then used to predict changes in college attendance of women. The economic payoff to a women's college education has undergone a remarkable increase. In the early part of the postwar period most college educated women were teachers and most female high school graduates were clerical workers. Teachers were paid only 4 percent more than clerical workers in 1948. By 1970, however, teachers were being paid 59 percent more than clerical workers. The salaries of college educated women in other fields also grew more rapidly than clerical salaries. During the 1970s, however, the salary premium received by young college educated women fell slightly, but in 1980s it exploded again rising from 53 percent in 1980 to 79 percent in 1986/87. The analysis indicates that these increases in the payoff to college were important contributors to the postwar explosion of female college enrollment rates. Tuition levels are also found to have very large effects on college enrollment. The paper concludes by projecting enrollment and college graduation rates for 1995. During the 1980s the payoff to college grew significantly and tuition rose much more rapidly than ability to pay. If these trends continue, the US Department of Education's projection that enrollment rates will grow about 10 to 14 percent between 1988 and 1995 will come true. If, however, the growth of public college tuition slows to only 2 percent above the rate of increase of wages, enrollment will grow at least 10 percent faster than the Department of Education projects. If tuition grows at the rate of wage inflation, our models project a new explosion of female college attendance.

I. THEORETICAL FRAMEWORK

The decision to attend college is assumed to be based on a rough calculation of benefits and costs. A young woman will attend college if the benefits of attending are greater than the costs. Benefits and costs are of two types--pecuniary and nonpecuniary. Let us begin by examining the pecuniary benefits and costs (B_m, C_m). Net monetary benefits may be written as:

$$1) \quad B_m - C_m = A(W_c - W_n) - 4((1-U).75*W_n + T)$$

where W_n is the yearly earnings of female high school grads working full time. Foregone earnings is assumed to be 75 percent of this figure.

W_c is the yearly earnings of female college graduates working full time.

A is a multiplier that reflects the number of years the young woman plans to be in the labor force and the rate at which she and her parents discount the future.

T is the direct costs of college attendance: Incremental room and board costs plus tuition at public colleges minus mean dollars of financial aid per student at public colleges.

$1-U$ is the probability of obtaining employment: 1 minus the expected unemployment rate.

Attending college also generates nonpecuniary benefits and costs. The net nonpecuniary benefits of college are a function of tastes for college, parental income, the performance of the student in high school and a multitude of other personal characteristics. They can be either positive or negative. The net non-pecuniary benefits received while attending college and after completion of college are represented by:

$$2) \quad D = a_0 + a_1 \ln Y + a_2 X + u$$

where Y is real permanent income of families with teen-age children

X is a vector of family and individual characteristics

Combining pecuniary and nonpecuniary benefits and costs, we have:

$$3) \quad B - C = A(W_c - W_n) - 4((1-U).75*W_n + T) + a_0 + a_1 \ln Y + a_2 X + u$$

The youth will chose to attend college if $B - C > 0$.

II. CROSS SECTION ANALYSIS USING INDIVIDUAL DATA

A linear probability model of the college attendance behavior of 29,141 young women who were juniors in high school in 1960 was estimated.²

$$4) \quad P_i = + b_0 + b_1X_{i1} \dots b_NX_{iN} + u$$

where P_i takes on the value of 1 if the "i" th individual attends college within two years of being first sampled in the spring of her junior year of high school and the value of 0 otherwise.

The twelve variables that characterize the payoffs and costs of college attendance were:

X_1 = the difference in 1959 dollars between the income of college graduate and high school graduate women. It is defined separately for urban and rural parts of each state and is deflated by the cost of living in that area. $X_1 = \$2120$. $\sigma_1 = \$470$.

X_2 = the earnings differential between college and noncollege occupations. It is measured in 1959 dollars deflated for the local cost of living. An average of full-time bookkeeper and secretary earnings was subtracted from an average of median full-time earnings of female elementary school teachers and medical and dental technicians. The local labor market is either the SMSA of residence or the non-SMSA portion of the state. $X_2 = \$1974$ and $\sigma_2 = \$596$. Hyp: $b_1 + b_2 > 0$ because higher monetary returns to college should attract more students.

X_3 = foregone earnings index is the median yearly earnings of female clerical workers in the SMSA or county of residence deflated for the local cost of living.³ $X_3 = \$2880$ or $\$.89$ per hour. $\sigma_3 = \$179$ or $\$.14$ per hour. There is no a priori expectation for the sign of b_3 .

X_4 = SMSA unemployment rate. $X_4 = 6.67$. $\sigma_4 = 2.20$.

X_5 = total costs (tuition + travel + room + board - savings at home) at the cheapest feasible college in hundreds of dollars deflated for the local cost of living. $X_5 = \$440$. $\sigma_5 = \$230$. Hyp: $b_5 < 0$.

X_6 = the additional cost of attending the cheapest four-year college over the cost of the cheapest feasible college of any type in hundreds of dollars deflated for the local cost of living. For the 42% of the sample where a four-year college is the cheapest feasible college of any type, $X_6 = \$189$. $\sigma_6 = \$218$. Hyp: $b_6 < 0$.

X_7 = tuition at the cheapest feasible college in hundreds of dollars deflated for the local cost of living. $X_7 = \$225$. $\sigma_7 = \$160$. The coefficient on tuition is expected to be negative because a) tuition is measured more accurately than the other components of minimum cost, b) the other public colleges of the state

typically have the same tuition, c) tuition may have unique psychological effects on the students planning.

X_8 = the proportion of a state's high school graduating class that is admissible at the cheapest feasible college. The effect of this variable should be close to zero in the highest ability quartile. It is expected to be positive in the other ability quartiles. $X_8 = .59$. $\sigma_8 = 30.6$

X_9 = distance to the cheapest feasible college. $X_9 = 20.8$. $\sigma_9 = 29.7$.

X_{10} = the cheapest feasible college is an away college. $X_{10} = .12$.

X_{11} = the cheapest feasible 4 year college is an away college. $X_{11} = .39$.

X_{12} = 1.0 if the cheapest feasible college is a two-year extension campus of a four year university without terminal vocational programs; and zero if the cheapest feasible college is either a four-year college or a two-year institution with terminal vocational programs. The variety of program offerings is much smaller on extension campuses, so we expect b_{12} to be less than 0. $X_{12} = .20$. $\sigma_{12} = .40$.

This model was fitted separately to data for five groups of high school juniors, each group defined by family income.

For estimating response to price, the Project Talent data used here are better than any previously available. The study is longitudinal and consequently it does not depend upon memory for measures of student ability or of high school location or character, and the dependent variable to actual attendance rather than plans to attend. The large sample size allows the estimation of separate modes for different income groups. It is national and thus has variation in critical variables such as payoff to college completed and the cost of attending college. Even its age is an advantage. Only limited amounts of scholarship aid were available at public institutions in 1961 when our sample was graduating from high school, so the difficulty of satisfactorily modeling the scholarship awarding process does not create serious problems. There are problems with the response rate for the Project Talent Sample, however; these problems are dealt with by assigning members of the special sample of non-respondents a weight of 20.

The set of sixteen background control variables described in the appendix were almost always significant and as a group were powerful explainers of college. The policy variables

(X5 ... X12) and the social and economic environment variables (X1 ... X4) generally had the sign predicted a priori and were statistically significant in most of the regressions.

The Monetary Payoff to College Attendance

The local college-high school earnings differential is a rather imperfect representation of the variable--the expected earnings payoff--suggested by theory. One might expect geographic variations in the expected earnings differential because an important source of information about this differential--direct observation of the wealthier life style associated with having been a college student--is local. Even if there were perfect knowledge, students preferring not to migrate would include the local differential in their calculation. Two measures of the higher earnings received by college women are used: the difference between the income of college and high school graduate women and the difference between the average median earnings of elementary school teachers and medical and dental technicians and the average for bookkeepers and secretaries. Six of the ten coefficients were significantly positive. Except for those coming from poverty families, coefficients were positive as hypothesized. The coefficients obtained in these models of female behavior are more consistently positive than those obtained for males.

A one standard deviation increase in both payoff measures raises attendance of both high and lower middle income students by 3 percent, raises upper middle income students by 9 percent, raises middle income students by 11 percent and lowers attendance rates of the low income students by 15 percent (see row 12 of Table 1). Since most students come from middle and high income families, the overall impact is projected to be a 6.3% increase in enrollment. Considering the fact that estimating a response to payoff by comparing local areas with different rates of return necessarily underestimates the response to nationwide changes in payoff, these projected responses are pretty large. Analysis of time series data is an alternative method of determining the impact of changes in the payoff to college and such an analysis will be presented in the next section of the paper.

Time Costs of Attending College

High local clerical wages are hypothesized to have two counteracting effects on college attendance. High wage rates mean the opportunity costs of college attendance are higher but it also means the youth is more likely to be able to finance college attendance by part time

work. The opportunity cost effect appears to be predominate for middle and upper middle income students. For these two groups, high wage rates appear to lower college attendance. For young people from lower-middle income backgrounds, high clerical wages raise college attendance rates, suggesting that greater availability of financing predominates for lower-middle income students. Clerical earnings had no effect on college attendance rates of poverty and high income students.

The other measure of the opportunity cost of a student's time is the unemployment rate. It has often been suggested that young people go to college in greater numbers when opportunities for getting a good job are poor. All but the highest income group seem to respond to unemployment in this manner. When unemployment rates were entered into similar regressions predicting male college enrollment not nearly as strong and consistent a pattern was obtained. When the opportunity cost of the young man's time is measured by the earnings of operatives a consistently negative effect is found (Bishop 1977). It would seem that for men it is low wage rates that encourage college attendance; for women it is high unemployment. A typical recession raises the unemployment rate by three percentage points. The equations predict that first time college attendance of low income women will rise by 10% (1.2/11.6), attendance by lower middle and middle income students will rise by 6% and attendance by upper middle income will rise by 12%. This finding that women's college enrollment decisions are quite responsive to the unemployment rate is consistent with time series evidence and with similar findings for college attendance of women over the age of 25 (Bishop and VanDyk, 1977).

Out of Pocket Costs of College Attendance

Examination of rows 5, 6, 7 and 9 of Table 1 reveals that the tuition and other out of pocket costs are a significant deterrent to college enrollment. Thirteen of the fifteen coefficients on dollar costs are negative and seven of these are statistically significant. In row 13 of that table we report the effect in 1961 of a general rise in tuition of \$200. Such an increase is equivalent to an \$800 increase at current price levels. Enrollment of the low income group is predicted to drop by more than half. Attendance of the lower-middle income group drops by 23 percent and attendance of the middle and upper middle income groups drop

by 20 percent. Only the high income group has a small response--a 6% reduction.

The effect of reductions in travel, room and board costs were also quite substantial for women. Establishing a four year public college in a town (which lowered costs of attendance by roughly \$471 in 1961) is predicted to raise their aggregate rate of college entry by 6 or 7 percentage points.

Establishing public two year colleges in town that had no public college before also has a substantial impact on college attendance rates. If the junior college that is established has an open door admissions policy, college entrance rates are predicted to rise by 4.3 percentage points. If the junior college has the same admissions policy as exists in the public 4 year colleges of the state, college entrance rates are predicted to rise by 3.0 percentage points. Since 1950 there has been a striking growth in the number of large cities with public two and four year colleges with generalized curriculums. During the twenty year period from 1955 and 1975 new public four year liberal arts colleges or universities were established in Albany, Atlanta, Baltimore, Boston, Buffalo, Cincinnati, Cleveland, Denver, Hartford, Houston, Milwaukee, New Haven, Pittsburgh, St. Louis, the suburbs of New York and Washington DC and many other cities. The number of public two-year institutions in the United States grew from 295 in 1955 to 634 in 1970 and 865 in 1986. In the urban North the proportion of the population living in SMSAs served by a local public two-year college grew from .45 to .90 between 1955 and 1970. The results presented in table 1 suggest that this improvement in the accessibility of public colleges provided a major stimulus to the explosive growth of female college attendance during the 1950s and 1960s.

Low income groups have proportionately higher responses to changes in tuition. Elasticities of demand were -.56 in the poverty strata, -.21 to -.23 in the 3 middle income stratas and -.06 in the high income strata. The growth of need based grant and loan aid during the 1960s and 1970s lowered the price of college attendance for poverty and middle income students. Since these groups had particularly high price elasticities of demand, the enrollment expansion that resulted may have been particularly strong.⁴

III. TIME SERIES ANALYSIS: 1947-1974

An analysis was also conducted of 1947 to 1974 time series data on the college enrollment rates of 18-19 and 20-24 year old females. In order to insure that the errors in our equation have relatively constant variance over a forty year period, both sides of equation

1 were divided through by foregone earnings (.75*W_n) and equation 2 was reformulated as a model for the ratio of the nonpecuniary benefits to foregone earnings. The benefit cost calculation that determines college entrance then becomes:

$$4) \frac{B - C}{.75*W_n} = \frac{A(W_c - W_n)}{.75*W_n} - \frac{4T}{.75*W_n} - 4(1-U) + a_0 + a_1 \ln Y + a_2 X + u$$

The growth path of female college enrollment was assumed to be logistic in form so the dependent variable was assumed to be the logit of the proportion of the group enrolled in college in October of the year. The time path of the logit of the college enrollment rate of 18-19 year old women is presented in Figure 1.⁵ The college enrollment rate of 18-19 year old women grew very rapidly during the first two decades of the postwar period, then slowed down during the 1970s and has accelerated again during the 1980s. The model estimated was:

$$5) \log \frac{P_c}{1-P_c} = b_0 + b_1 \frac{(W_c - W_n)}{.75*W_n} - b_2 \frac{T}{.75*W_n} - b_3 U + b_4 \ln Y + b_5 \text{BirthOrder} + u$$

The following description of the analysis was written in 1976.

The results of fitting equation 5 to aggregate time series data on the logit of the enrollment to population ratio of 18-19 year olds and 20-24 year olds for the period 1947 to 1976 are given in table 2. The most striking thing about the regressions is the powerful response of female attendance rates to both the future payoff and the current cost of college attendance.

Changes in Taste for College and Its Economic Payoff

The relative wage ratio that is hypothesized to influence women's decisions is rather different from the ratio used in the regressions predicting male enrollment that both Freeman and I have run. Data on incomes of women classified by education are not available for the whole period, so occupational wage rates were used. The base is the median yearly wage and salary income of full time full year female clerical workers. For the early years for which this series is not available, it is extrapolated back by the median wage and salary income of all female clerical workers. Prior to 1961 the college wage was a weighted geometric average of four Endicott starting salaries (weight=.44), and the average salary of public school teachers (weight=.56). After 1961 nursing salaries (weight=.106) and assistant professor salaries

(weight=.042) were spliced into the series with Endicott and teacher weights correspondingly reduced.

The teacher salary used was a weighted average of elementary and secondary school teacher wages received by men and women. For most of the period the Endicott surveys did not report women's starting salary offers separately. While the resulting index tends to be dominated by offers made to men, the weights assigned to the college majors for which salary information is available did reflect the distribution of women by major. Wage rates not specific to women were used because no comparable series on the wages of college trained women was available. Between 1969 and 1975 separate information was available on the starting salaries of female college graduates. During this period starting salary offers to women were improving relative to those of men.

Between 1947 and 1971 the payoff to a woman's college education underwent an astonishing increase. Our payoff variable, the salary premium for a college education divided by 75 per cent of a full time clerical worker's earnings was .11 in 1947 and rose steadily until it reached a peak of .76 in 1971. The rise in payoff was due to the combination of declines in the relative wage of female clerical workers and rise in the relative wage of teachers. Since 1971 there has been a slight decline. The payoff ratio reached .66 in 1975.

Estimating the impact of this female payoff ratio on college attendance is quite difficult, for it is highly collinear with the other variables in the model. These other variables that have strong trends include the log of real income per capita the mean birth order of the cohort. As a result the coefficients on each of these variables are sensitive to whether the other variables are included in the model and the lag structure that is assumed for its impact. When birth order is added to the model the coefficient on the payoff variable declines precipitously (Compare lines one and two in each panel of Table 2).

Cost of College

The direct costs of attending college are defined as tuition, plus room and board costs at a public college in ones own state minus the mean financial aid per student and the savings at home consequent upon not having to feed and house the student (assumed to be \$258 in 1971). Room and board costs were included because cross section work has discovered that both living costs and tuition effect college attendance. Measures of the availability of commuter colleges and the cost of such a commute are not currently available so our cost variable is necessarily

an imperfect one. The direct cost of college attendance was measured for each state and an average using state populations as weights was taken to construct a national figure. The ratio of the direct cost of college to foregone earning has been declining throughout the postwar period. This dollar cost figure was about 28-29 percent of the 1500 hours of clerical earnings in 1947/48 and remained pretty constant through 1964. Then, primarily because of the growth of federal need based financial aid, it began to fall reaching 24 percent in 1969 and stabilizing that level through 1975.

The coefficients on tuition that are freely estimated generally range between -2.8 and -8.2. They are quite consistent with the cross section results reported earlier which if translated into a time series specification by multiplying by 75 percent of the 1961 clerical wage would be -5.64 for tuition and -4.536 for cost reductions due to establishing new colleges (taking account of the fact that room, board, and travel costs are discounted to 25 percent of fare value.) The coefficients on cost suggest that on a per dollar basis, a reduction in out-of-pocket current costs has a much larger impact on attendance than a change in the present discounted value of the difference between college and high school earning streams (even when discount rates on the order of .20 are used). This has also been found in cross section work (Bishop, 1977).

Other Variables

Cross section work on college attendance finds that having many siblings and not being the first born lowers performance on standardized tests and reduces the probability of attending college. It has been suggested that since the cohort of children born late in the baby boom were typically reared in a family with many siblings competing for attention and resources, it is likely that this cohort will be somewhat disadvantaged.

The mean birth parity of a cohort is a reasonable proxy for this effect and is available for the cohorts in our sample for the nation as a whole. The mean birth parity of children born in 1929 (18 year olds in 1947) was 3.1. The depression and the war caused a substantial reduction in fertility so the mean parity fell until 1947 (18 year olds in 1965) when it reached a low of 2.4. After that the mean parity began to rise reaching 2.8 in 1956 (the 18 year olds in 1974).

While the coefficients on the parity variable are negative in the two younger age groups,

neither of the coefficients is as large as its standard error. If the coefficient is believed, however, the effect of parity on college attendance is not inconsequential. Since 1965, the parity of 18/19 year olds has risen about .4. The coefficient on parity implies that this rise in parity has lowered college attendance by 2 percentage points or about as much as an 8 to 10 percent drop in real per capita income would. When the dependent variable is the logit of the ratio of college students to population, the magnitude of the coefficient almost doubles and starts to approach statistical significance. This suggest that parity influences high school graduation rates as well.

A measure of the mean number of children born to high school graduates before the woman's 18th, 20th, and 25th birthday was constructed and entered into the regressions. It was never significant and seldom had the correct sign.

It has often been hypothesized that college enrollment rates will rise in a recession because of the difficulty young people experience in obtaining jobs. This hypothesis has been suggested as the reason for the maintenance of high college enrollment rates during the 1975 recession in spite of continuing declines in the return to schooling.... Two of the age groups have the hypothesized positive coefficient on the unemployment rate of women 20 to 24 years old. Neither coefficient is statistically significant, however.

In the 18/19 year old regression the coefficient on the unemployment rate implies that holding other things constant, a 1 percent rise in unemployment will cause a one half percentage point rise in the college enrollment rate of women. Other things do not remain constant, however, for Okun's law implies that every one percent rise in the aggregate unemployment rate is associated with a 2 to 3 percent decline in GNP. Our measure of real per capita income will, consequently, fall by about 2 percent when our unemployment measure rises 1 percent. Using the per capita income coefficient in the same regression, we estimate this effect, to be a fall of 0.3 percent in the college attendance rate of 18/19 year olds. The net effect of a recession in which unemployment rates rise 3 percent, therefore, is an approximately .6 percentage point rise in attendance rates of 18/19 year old women.

With aggregate time series data, it is not possible to definitively apportion responsibility for the trend growth in female college attendance. We therefore turn to cross section studies for help. From Sweet and Winsborough's study of college attendance as a function of mother's education and birth order, we have taken estimates of the impact of birth order. From our own work on college attendance of women we obtain an estimate of the impact of cost and trend

improvements in family income and parental education. In line three of Table 2 we present the results of estimating models in which the cross section derived estimates of the coefficient for birth order and cost are imposed. (The imposed cost coefficient is -3.875 rather than -5.6 because the base of the enrollment ratio is population of the age group rather than high school juniors, and because attendance as a college sophomore, junior, or senior is less sensitive to cost than initial entry into college.) No major changes in the coefficients on payoff and permanent income result, but the standard errors of the free parameters decline significantly.

This exercise has demonstrated the difficulty of apportioning responsibility for the post war rise in female enrollment between payoff and trend rises in tastes for college and resources to pay for it. This exploratory effort suggests that mining cross section studies for outside estimates of the effect of family income, education and birth order is a potentially fruitful line of research.

The results presented in row 3 of Table 2 were then used to forecast the change in college enrollment rates between 1975 and 1980 and between 1980 and 1987. The forecasts made in late 1976 predicted that the college enrollment ratio for 18/19 year old females would increase by less than one percentage point in 1980 and then increase by about 5.2 percentage points between 1980 and 1987. College enrollment rates were projected to stagnate between 1975 and 1980 because 18/19 year olds of this period were from larger families and because the decline of unemployment as the 1974/75 recession came to an end was expected to reduce college enrollment rates. What in fact happened was that enrollment rates rose 2.7 percentage points between 1975 and 1980 and then increased a further 7.4 percentage points between 1980 and 1987. The 1976 forecasts correctly predicted that enrollment would grow more slowly in the 1970s than in the 1980s but they understated the rate of advance during both periods.

What caused the errors? In order to forecast enrollment rates it was first necessary to project real per capita income, the payoff to college and the ratio of college costs to foregone earnings. The forecast assumed that the cost ratio and the payoff ratio would remain constant while real per capita income would increase at 2.87 percent per year and unemployment would decline to 5.3 percent in 1980 and 1987. Only the unemployment projection came close to being true. Real per capita income grew much less rapidly than projected (about 1.7 percent

per year), the ratio of out-of-pocket costs to foregone earnings and the payoff to college, while static in the latter half of the 1970s, appears to have increased substantially during the 1980s. Substituting realized levels of income, payoff and cost does not eliminate the underprediction of enrollment growth. If the coefficients in the third row of table 2 are used to forecast the enrollment rate in 1987, the lowered growth of per capita income and the substantial rise in the ratio of out-of-pocket college attendance costs to foregone earnings lower predicted 1987 enrollment by roughly the amount that the higher payoff increases it.

The judgement made 15 years ago: *With aggregate time series data, it is not possible to definitively apportion responsibility for the trend growth in female college attendance....* appears to be correct. Unfortunately the effort to overcome this problem by imposing cross-section estimated coefficients for out-of-pocket costs and birth order did not, in this application, solve the problem. The resulting equation failed to forecast the rapidity of subsequent growth of female college attendance even when the realized levels of right hand side variables were substituted into the equation.

IV. TIME SERIES ANALYSIS: 1949-1987

Additional evidence on the role of costs, incentives and capacity to pay can be obtained by analyzing the determinants of aggregate college enrollment rates during the last forty years. The models that were estimated for 1949 through 1987 predicting the logit of the college enrollment rate for 18-19 year old women and 20-24 year old women are very similar to the models presented in the previous section. The payoff variable was constructed by splicing the payoff variable used in the analysis of 1947 to 1974 enrollment rates into Current Population Survey data on the weekly earnings of young women classified by years of schooling for the years 1963 through 1987.⁶ The payoff variable for the 1963 to 1987 period is defined as the weekly wages of female college graduates with 1 to 5 years of experience times 52 minus the weekly wages of female high school graduates with 1 to 5 years of experience times 52 all divided by an estimate of the foregone earnings--the weekly wage of high school graduates with 1 to 5 years experience multiplied by 39. The ratio of the college wage premium to foregone earnings was only 20 percent in 1947-48 but then rose steadily to 80 percent in 1968 before falling back to 64 percent in 1976-78. The wage premium then rose rapidly to 105 percent in 1986-87 (see figure 1). It was hypothesized that enrollment would respond to changes in the payoff with a lag so the analysis employed a three year lagged weighted average of this index.

The cost variable is tuition at 4 and 2 year public colleges divided by estimated foregone earnings--the high school weekly wage times 39.⁷ This ratio was 7.2 percent in 1948-49, 6.5 percent in 1954-55, 9.0 percent in 1963-64 and 10.57 percent in 1972-73. It fell to 9.3 percent in 1979-80 and then increased to 12.5 percent in 1986-87 and 13.55 percent in 1988-89. The unemployment variable is the average unemployment rate for 18 to 24 year old females. Real per capita personal income captures the rising consumption demand for higher education and improvements in the ability to pay.

The results of this analysis are reported in row 1 and 3 of Table 3. The models estimated turn out to be quite similar to the results obtained for the 1947 to 1974 period. The coefficients on the cost variable are higher for the 1954-87 time series analysis because tuition rather than tuition plus adjusted room and board is the numerator of the ratio and because a lagged average of this ratio was used rather than the current level.

There is substantial cross section evidence that academic achievement in high school influences the probability of going to college. This suggests the hypothesis that the test score decline may have been one of the causes of the slowdown in the rate of growth of college enrollment and graduation rates during the 1970s. If, however, colleges reacted to the decline in the quality of entering students by lowering admission and graduation standards, there might be no such tendency for college enrollment and graduation rates to decline when aggregate achievement levels decline. These hypotheses can be tested by adding a measure of achievement levels attained by the end of high school to the estimated model. The effect of the test score decline on college enrollment of the cohorts with low test scores is examined in row 2 and 4 of Table 3. Impacts on the ratio of BAs to high school diplomas 4 to 10 years previously are presented in row 5. The variable used to characterize achievement at the end of high school was the mean scores for the age group on the Iowa Test of Educational Development (ITED) when they were 11th and 12th graders all measured in standard deviation units. Data on SAT and ACT tests can not be used because these tests were taken at first by a highly selected group of students and only more recently by more representative samples of college bound students. Consequently, trends in scores on these tests are biased by the decreasing selectivity of those who took the test. ITED data for the state of Iowa is used because about 95 percent of the public and private schools in the state of Iowa regularly participated in the testing program.

The achievement levels of students at the end of high school have varied a great deal over time. Mean scores for 11th and 12th grade students in Iowa are plotted in standard deviation units in Figure 1. During the 1950s and up to 1966 test scores were rising in Iowa and elsewhere around the nation.⁸ In 1966, however, the academic achievement of high school students stopped rising and began a decline that lasted about 13 years. On the ITED the composite scores of Iowa 9th graders dropped .283 SDs and the scores of seniors dropped .35 SDs or about 1.25 grade level equivalents. Comparable declines occurred throughout the country and for junior high school students as well.⁹ It appears that recent efforts to improve the quality and rigor of the curriculum have had an effect, as test scores are rising again. By 1988 Iowa 12th graders had recouped about three-quarters of their previous decline and eleventh graders had surpassed their 1965 record.

High school test scores appear to have significant effects on enrollment rates. The influence of a variable on the probability of attendance can be calculated by multiplying its

coefficient by $P_i*(1-P_i)$. Effects of a variable expressed in percentage increases or decreases in enrollment can be calculated by multiplying the coefficient by $(1-P_i)*100$. For 1987, consequently, percentage effects can be obtained by multiplying by 57 for 18/19 year old women, by 77 for 20 to 24 year old women and by 66 for college to high school graduation ratios. Table 4 reports calculated percentage effects of historical changes in real income, tuition, test scores and the payoff to college for three different time periods--1949 to 1969, 1969 to 1979 and 1979 to 1987. The one-third of a standard deviation decline in test scores between 1969 and 1979 is estimated to have lowered enrollment of 18-19 year old women by 12 percent and lowered enrollment of 20-24 year old women by 5 percent. The rise in test scores during the 1980s means that much of this loss has or will shortly be made up.

The estimated impact of the payoff to college and tuition costs are reduced by the addition of test scores to the model but they remain substantial. The large increase in the payoff ratio from .22 to .78 between 1949 and 1969 is estimated to have increased enrollment by 37 percent for 18-19 year old women and 81 percent for 20-24 year old women. The decline of the college payoff during the 1970s appears to have lowered enrollment by 6 percent for 18-19 year old women and 15 percent for 20-24 year old women. The recent rise of the college payoff is estimated to have increased enrollment of 18-19 year old women by 18 percent and increased the enrollment of 20-24 year old women by 28 percent. Increases in real incomes have also substantially increased college going rates. However, the deceleration of productivity growth after 1973 has reduced the growth of real income and this has in turn contributed to the slowdown in the growth of college attendance in the 1970s and 1980s. In the model for 18-19 year old women, the coefficient on the unemployment rate is substantially larger than the coefficient on real income. This suggests that a recession may actually raise college attendance rates of this age group. For 20-24 year old women, however, the coefficients have the opposite pattern implying that a recession lowers college attendance rates.

The costs of college have also been rising. Between 1979 and 1987, public college tuition rose 40 percent more than ability to pay--the wages of recent female high school graduates. The results suggest that this increase in tuition lowered enrollment rates of 18-19 year old women by 14 percent and lowered enrollment of 20-24 year old women by 48

percent. If public college tuition had not risen so substantially, there probably would have been a much stronger increase in college enrollment.

Table 3 also presents the results of an analysis of time series changes in the number of bachelors degrees that colleges report awarding to women. The dependent variable was the logit of the ratio of BA's awarded to women in a given year to the average number of high school diplomas awarded to women 4 to 9 years previously. The lagged weighted average of high school diplomas was used because many BA recipients are substantially older than the 21-22 year old norm. The test score variable was a lagged average ITED test results using weights identical to those used in constructing the estimate of the average number of high school diplomas awarded. The tuition and payoff variables were unweighted averages of the values for the previous 5 years.

The results are quite similar to those obtained in the enrollment rate models. The coefficient on real per capita income is smaller because BAs are compared to high school diplomas not the number of 20-24 year old women. The coefficient on test scores is also lower than in the enrollment models, probably, because of difficulties of selecting the correct weighted lags for the test score variable.

Table 5 presents projections of changes in enrollment and college graduation rates between 1987/9 and 1995. For purposes of comparison, the Department of Education's (1989) projections are presented in the first column of the table. The projections presented in columns 2, 3 and 4 are based on the models presented in Table 3. These projections are based on the following assumptions: no changes in the unemployment rate, a slow 1.2 percent per year increase in per capita income through 1995, and continued increase in the payoff to college at the rate that prevailed during 1979-87.¹⁰ The predicted effect of the assumed trends in payoff, real income and test scores are given in columns 5-7 of the Table 5.

The forecasts are quite sensitive to the assumed behavior of tuition. Column 2 presents a forecast which assumes that tuition will grow at roughly the rate that prevailed during the 1980s--that is 4 percent per year faster than the wage rates of female high school graduates. This assumption results in a projection of enrollment growth that is very close to the projection made by the Department of Education. If the rate of growth of tuition slows to only 2 percent faster than wages, enrollment growth is projected to be 12 percent greater than Department of Education forecasts for 18-19 year old women and 24 percent greater for 20-24 year old women and the projected number of bachelors degrees exceeds Department of

Educations forecasts by 5 percent (see column 3). If tuition rises no faster than wage rates, enrollment is projected to explode--exceeding Department of Education forecasts by 20 percent for 18-19 year old women and by 50 percent for 20-24 year old women (see column 4).

These projections should be taken with a grain of salt, however, for two reasons. First, despite the small standard errors on the coefficients on payoff and tuition variables, the magnitudes of the coefficients are sensitive to small changes in specification and in the time period used to estimate the model. Second, enrollment rates are quite sensitive to assumptions about the future path of tuition and payoff. These variables are particularly difficult to forecast accurately, so errors in forecasting these variables may cause projections to be wide of the mark. The projections might best be seen as "what if" simulations of the consequences of alternative public policies regarding the funding and pricing of higher education.

In this respect all three analyses tell a consistent story. In all three analyses, higher family incomes, higher local unemployment rates and higher test scores increase college attendance rates. Female college enrollment and completion is very sensitive to tuition costs and to anticipated labor market benefits of a college degree. In all three analyses, a \$500 decrease in tuition had a substantially larger (7 to 10 times greater in the analysis of 1949 to 1987 time series data) effect on enrollment and completion than a \$500 increase in the payoff to college. This means that increases in the number of college students and graduates can be generated much more cheaply by subsidizing public college tuition than by paying higher wage rates to graduates.

APPENDIX ON CROSS-SECTION DATA

Data

The data base for the cross-section analysis is 29,141 females who were high-school juniors in 1960 and for whom information was obtained in one of the two Project Talent follow-up efforts. Over 95 percent of our sample are in the Project Talent 5 percent stratified random sample of the nation's high schools, so the juniors originally contacted in 1960 are broadly representative of the total population of juniors (Flanagan [101]). The proportion of these juniors who responded to one of the questionnaires mailed in 1962 and 1966 was only 53 percent, however. More intensive follow-up procedures were used for a 5 percent sample of the mail-questionnaire non-respondents.

A comparison of the two samples reveals that responding to a mail questionnaire is positively related to college attendance. Controlling for family background, the college-attendance rate of the non-respondent sample was two-thirds that of the respondent sample. Probability of responding to the mailed questionnaire is not solely a function of college attendance, however, so an unweighted model will yield biased estimates of many of the crucial parameters. Manski and Lerman () have shown that the solution to this statistical problem is to give each observation in the intensive follow-up sample of mail-questionnaire non-respondents a weight of 20.

Selection of the College That Represents the College Availability Environment

The college used to represent a student's college availability was required to meet the following five conditions:

1. The college had to provide a broad range of programs. Therefore Bible schools, seminaries, and business, engineering, and teachers colleges were excluded.
2. The college had to admit women.
3. The college could not be so selective that it accepted less than 20 percent of the high-school graduating class of the state in which it was located.
4. A denominational college had to be of the same religion-Catholic, Jewish, or Protestant-as the student. There is a very strong tendency for students to avoid denominational colleges. As a result, in 1967 only 2.9 percent of the freshmen at Catholic colleges were Protestant and only 7.7 percent of the freshmen at Protestant colleges were Catholic.

5. In the South, a college generally had to be of the same race as the student. The only exception to this was that if the number of black students at a predominantly white college was either greater than 15 or a higher proportion of the student body than .10 times the black proportion of the state's population, that college was considered biracial. By this very liberal criterion, no white colleges were biracial in Alabama, Georgia, Mississippi, and South Carolina. There were one each in Arkansas and Florida, Seven or eight in Louisiana and North Carolina, 10 out of 38 in Tennessee, and 39 out of 90 in Texas.

Within the set of colleges defined by the above five conditions, the college that was assumed to be "most attractive" was the one that was least costly to attend. Cost was defined to include travel and incremental room and board costs. A computer program was written so that the 29,141 students in 1500 high schools selected the cheapest college meeting the five requirements described above from the pool of over 2000 possible colleges. Use of the minimum-cost criterion is justified by the fact that the college least costly to attend is the one least likely to be impossible to finance. When financing out-of-pocket costs is not a constraint, the cheapest college will still rank high by other criteria. For the 86 percent of the sample whose minimum-cost college was within commuting distance, the mean distance to the college was 10.8 miles. The physical closeness of the college no doubt increased its salience. Medsker and Trent [19] found that in towns with a junior college, almost three-quarters of those who went to college attended the local junior college (i.e., the minimum-cost college). Low cost and physical proximity need be dominant considerations for only some of the students, however, for many others will focus on the same college simply because that is where most of their friends are attending. Lower expected pecuniary and nonpecuniary benefits may in specific instances outweigh advantages of low costs, but for students near the margin on the decision to attend or not to attend, this will happen only infrequently. If one of these students is admissible at the low-cost public college of a state, a lowering of that college's expenditures per student or a rise in tuition at higher-cost private colleges is not likely to dissuade the student altogether from attending college. Hopkins [14] found that when tuition and proximity were held constant, a state's college-attendance rates were not related to per student expenditures in the public and private colleges of that state.

This constrained selection of the cheapest form of college attendance usually results in

a local public college representing the college-availability environment. Using the approach described above, the primary determinants of the costs of college attendance turn out to be the level of in-state tuition, the distance from the student's high school to the nearest public institution, and whether a student lives in a political jurisdiction with access to a low-tuition junior college.¹¹

Except for a variable describing the extra costs of a four-year college, the extra distance of a four year college and the relative admission selecting of a four year college, only the cheapest college's characteristics enter the model.

Cost-of-Living Index: Food at home and comprehensive cost-of living indexes were developed for each state and some of the major SMSAs from data in Lamale and Stroz [1960] and Brackets [1963, 1967]. Where 1960 data were unavailable, 1966 data were used. Price indexes for SMSAs not included in these studies were predicted by an FHA housing-cost index, state and city sales tax rates, and dummies for subregion. The 1966 study made regional estimates for nonmetropolitan areas, and these were averaged with the local SMSA indexes to produce an index number for each state.

Controls for Neighborhood Characteristics

There were two variables measuring the social status of the neighborhood in which the student went to high school.

X_{13} = median years of schooling of men and women in the community. The neighborhood is defined as the census tracts immediately surrounding the high school in big cities, the town or village in suburbs and small cities, and the rural part of the country in communities with populations smaller than 2500. $X_{13} = 10.4$. $\sigma_{13} = 1.5$. Hyp: $b_{13} > 0$.

X_{14} = real median family income in hundreds of dollars. The neighborhood is defined as the census tracts immediately surrounding the high school in big cities, the town or village in suburbs and small cities, and the rural part of the country in communities with populations smaller than 2500. $X_{14} = \$6120$ $X_{14} = \$1460$. It is expected that the sum of the standardized coefficients on these variables will be positive because the aspirations of a student's peers and the quality of the high school are a function of a community's status and resources.

Individual Characteristics used as controls in the Cross Section Analysis

In addition to the 14 variables characterizing the cost and payoff to college described in the text, sixteen measures of individual characteristics which influence college going were controlled for.

X15= years of schooling of father. $X_{15} = 11$. $\sigma_{15} = 3.0$. Hyp: $b_{15} > 0$.

X16= difference between mother's and father's education.
 $X_{16} = 0.0$. $\sigma_{16} = 1.2$. Hyp: $b_{16} > 0$.

X17= permanent income proxy. An estimate of family income based on 10 questions about size and value of home, number of cars, and the ownership of various consumer durables. This variable was also used to stratify the sample. Hyp: $b_{17} > 0$.

X18= number of siblings. $X_{18} = 3.7$. $\sigma_{18} = 2.2$. Hyp: $b_{18} < 0$.

X19= an index of the frequency and recency of school changes. Frequent changes may reflect an unstable home environment. A change of schools cannot help but disrupt the educational process and the more recent the change the greater will be the effect on college attendance. Hyp: $b_{19} < 0$.

X20= Project Talent's academic aptitude composite minus the students score on the Math Information test. Hyp: $b_{20} > 0$.

X21= a dummy which equals 1 if the student is living in a two parent family. $X_{21} = .78$. Hyp: $b_{21} > 0$.

X22= student has won prizes in music. $X_{22} = .027$. Hyp: $b_{22} > 0$.

X23= Yiddish or Hebrew spoken in home. $X_{23} = .066$. Hyp: $b_{23} > 0$.

X24= index of the student's involvement in religious activities.

X25= eldest sibling. $X_{25} = .37$. Hyp: $b_{25} > 0$.

X26= lives on a farm. $X_{26} = .082$. Hyp: $b_{26} < 0$.

X27= father has white collar occupation. $X_{27} = .314$. Hyp: $b_{27} > 0$.

X28= Black. $X_{28} = .076$.

X29= % Black in high school.

X30= residential high school. $X_{30} =$ Hyp: $b_{30} > 0$.

ENDNOTES

1. Bureau of the Census, "School Enrollment--Social and Economic Characteristics of Student: October 1988 and 1987," Current Population Reports, Series P-20, No. 443, April 1990 and "Educational Attainment of the Civilian Population: April 1947," Current Population Reports, Series P-20, No. 15., May 1948.
2. Maximum likelihood programs that can estimate logistic models containing large numbers of variables for data sets of this size were not available at the time the analysis was conducted. Consequently, linear probability models had to be used.
3. Using 1300 hours as the estimate of study time and taking account of the lower wage rates received for part-time and summer jobs, the ratio of before tax foregone earnings to yearly earnings of clerical workers is .50. The cost of lost work time is the after-tax wage rate. Applying a marginal tax rate of .20 reduces the ratio of .40.
4. The marginal subsidy cost of an extra student--the per-student subsidy of instructional cost plus the difference between the price paid and the marginal revenue--is inversely related to the elasticity of demand. If the offer of a \$200. grant has the same effect on enrollment decisions as a \$200 reduction in tuition, shifting public subsidy of higher education to financial aid is a more efficient way of stimulating enrollment increases. It is quite likely, however, that grant aid has smaller effects on college enrollment probabilities than equivalent reductions in tuition. Important decisions which influence college access are made in middle school and the early years of high school. A state policy of low tuition and many accessible colleges is likely to have larger effects on these decisions than the uncertain prospect of need based financial aid to attend expensive geographically remote colleges. Consequently, it is not clear that expanded financial aid is a more efficient way of increasing college enrollment than low tuition levels. Lee Hansen (1984) argues that the expansion of student aid between 1972 and 1980 did not result in students from low income backgrounds becoming a larger proportion of college students.
5. In order to place the logit on the same scale as the other variables plotted in Figure 1, the variable that is plotted is one-half the logit plus one.
6. Lawrence Katz and Kevin Murphy, "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," National Bureau of Economic Research, April 1990. pp. 1-61.
7. The variable employed in the analysis is unweighted average of the current value and one year lag of the tuition ratio. A lagged average was used because it was hypothesized that perceptions of the cost of college would not immediately respond to changes in actual tuition levels and because averaging reduces measurement error. The tuition variable used in the analysis of the previous section was spliced onto the mean public college tuition data reported in U.S Department of Education, Digest of Educational Statistics: 1989, Table 258. and Projections of Educational Statistics to 1981-82, Table 45, National Center of Education Statistics. For the 1972 to 1989 period foregone earnings is estimated to be equal to 39 times the weekly wages of

female high school graduates (Katz and Murphy 1990). A time series for the 1954 to 1972 period was constructed by splicing the mean clerical earnings index used in the analysis described in section two of the paper onto the weekly wage index.

8. Data on ITED trends was kindly provided by Robert A. Forsyth (personnel communication) "Achievement Trends for the Iowa Tests of Educational Development in Iowa: 1942-1985," Iowa City:Iowa Testing Programs, 1987. Other tests that have been administered for long spans of time to stable test-taking populations also exhibit a positive trend during this period. Roger Farr and Leo Fey, "Reading Trend Data in the United States: A Mandate for Caveats and Caution," The Rise and Fall of National Test Scores, ed. by Gilbert Austin and Herbert Garber, (New York, New York: Academic Press, 1982), pp. 83-142. Between 1958 and 1966 Minnesota high school juniors gained .39 SDs on the Minnesota Scholastic Aptitude Test. see Edward O. Swanson, "Fashions in Test Scores, or What Goes Up Must Come Down?" Student Counseling Bureau Review, University of Minnesota, September 1973, Vol. 25, No. 1. The periodic national standardizations of the ITED also exhibit an increase during the 1960s.
9. From peak to trough the decline for seniors was .38 SDs on the SAT and .32 SDs on the ACT. For 11th graders it was .28 SDs in the Illinois decade study, .24 SDs on the Preliminary Scholastic Aptitude Test and .22 SDs on the California Achievement Test. The scores of 9th and 10th graders declined .42 SDs on the Metropolitan Achievement Tests. Koretz, Daniel, et. al. Trends in Educational Achievement. Washington: Congressional Budget Office, 1986 and Brian K. Waters, The Test Score Decline: A Review and Annotated Bibliography, Technical Memorandum 81-2, Directorate for Accession Policy, Office of the Secretary of Defense, April, 1981.
10. Bishop and Carter (1990) have forecasted the growth occupational skill demands and the occupational demand for college graduate workers through 2000. Those forecasts imply that labor markets will remain tight during the 1990s and that the payoff to college is likely to continue to increase at rates similar to those that prevailed during the 1980s. made by Bishop and Carter (1990) have projected growth rates of occupation
11. In 1961, many publicly supported institutions charged lower fees to students who applied from within the district that provided financial support. Schools of this type were the municipal universities of Kansas, Kentucky, Ohio, Nebraska and New York and public junior colleges in Arizona, Colorado, Florida, Idaho, Illinois, Iowa, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Oregon, Texas, and Wyoming. In some states the in-out district price differential was small-\$40 or so in Iowa-but in others, Illinois and Maryland for instance, it was between \$200 and \$300.

BIBLIOGRAPHY

- Adkins, Douglas L. The Great American Degree Machine. The Carnegie Foundation for the Advancement of Teaching, 1975.
- Bishop, John. "The Effect of Public Policies on the Demand for Higher Education." Journal of Human Resources, Vol. XII, No. 3, Summer 1977.
- Bishop, John H. "Did the Test Score Decline Cause the Productivity Growth Decline." American Economic Review, March 1989a, pp. 178-197.
- Bishop, John H. and VanDyk, Jane. "Can Adults be Hooked on College? Some Determinants of Adult College Attendance," Journal of Higher Education. January/February 1977.
- Bishop, John. "The Private Demand for Places in Higher Education." Ph.D. dissertation, University of Michigan, 1974.
- Bishop, John and Carter, Shani. "The Worsening Shortage of College Graduate Workers." Center for Advanced Human Resource Studies Working Paper 90-15, October, 1990, 1-48.
- Brackett, Jean. "City Workers Family Budget for a Moderate Living Standard, Autumn 1966." BLS Bull. 1570-1. Washington: U.S. Department of Labor, Bureau of Labor Statistics, 1967.
- _____. "Intercity Difference in Family Food Budget Costs." Monthly Labor Review, (October 1963): 1189-94.
- Bureau of Labor Statistics, Handbook of Labor Statistics, Table 65, 1983.
- Bureau of the Census, "School Enrollment--Social and Economic Characteristics of Student: October 1988 and 1987," Current Population Reports, Series P-20, No. 443, April 1990.
- Bureau of the Census, "Educational Attainment of the Civilian Population: April 1947," Current Population Reports, Series P-20, No. 15., May 1948.
- Campbell, Robert & Siegel, B.N. "The demand for Higher Education in the United States, 1919-1964." American Economic Review 57 (June 1967): 482-94.
- Farr, Roger and Leo Fey, "Reading Trend Data in the United States: A Mandate for Caveats and Caution," The Rise and Fall of National Test Scores, ed. by Gilbert Austin and Herbert Garber, (New York, New York: Academic Press, 1982), pp. 83-142.

- Flanagan, John C. et al. The American High School Student. Pittsburgh: University of Pittsburgh, Project Talent Office, 1964.
- Forsyth, Robert A. (personnel communication) "Achievement Trends for the Iowa Tests of Educational Development in Iowa: 1942-1985," Iowa City:Iowa Testing Programs, 1987.
- Freeman, Richard. "Over Investment in College Training?" Journal of Human Resources 10 (Summer 1975): 287-311.
- Hansen, W. Lee. "Economic Growth and Equality of Opportunity: Conflicting or Complementary Goals in Higher Education." Education and Economic Productivity, edited by Edwin Dean. Cambridge, Mass: Ballinger Publishing Company, 1984.
- Hauser, Robert and Featherman, David. "Equality of Schooling: Trends and Prospects." Sociology of Education, Vol. 49, April 1976, pp. 99-120.
- Hopkins, T. "Higher Education Enrollment Demand." Economic Review, Vol. 12, March 1974, pp. 53-65.
- Jackson, Gregory A. "Did College Choice Change During the Seventies?" Economics of Education Review, Vol. 7, No. 1, pp. 15-27, 1988.
- Katz, Lawrence and Murphy, Kevin. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," National Bureau of Economic Research, April 1990. pp. 1-61.
- Koretz, Daniel. Trends in Educational Achievement. Washington: Congressional Budget Office, April 1986.
- Lamale, Helen & Stroz, Margaret. "The Interim City Workers Family Budget." Monthly Labor Review (August 1960): 785-808.
- Manski, Charles & Lerman, Steven. "The Estimation of Choice Probabilities from Choice Based Samples." Pittsburgh: School of Urban and Public Affairs, Carnegie-Mellon University, May 1976. Unpublished.
- Medsker and Trent
- Murphy, Kevin and Welch, Finis. "Wage Premiums for College Graduates Recent Growth and Possible Explanations." Educational Researcher, May 1989.
- National Center for Education Statistics, Digest of Educational Statistics 1989, US Department of Education, 1989.

National Center for Education Statistics, Projections of Educational Statistics to 1981-82, US Department of Education, 1972.

National Center for Education Statistics, Projections of Educational Statistics to 2000, US Department of Education, 1989.

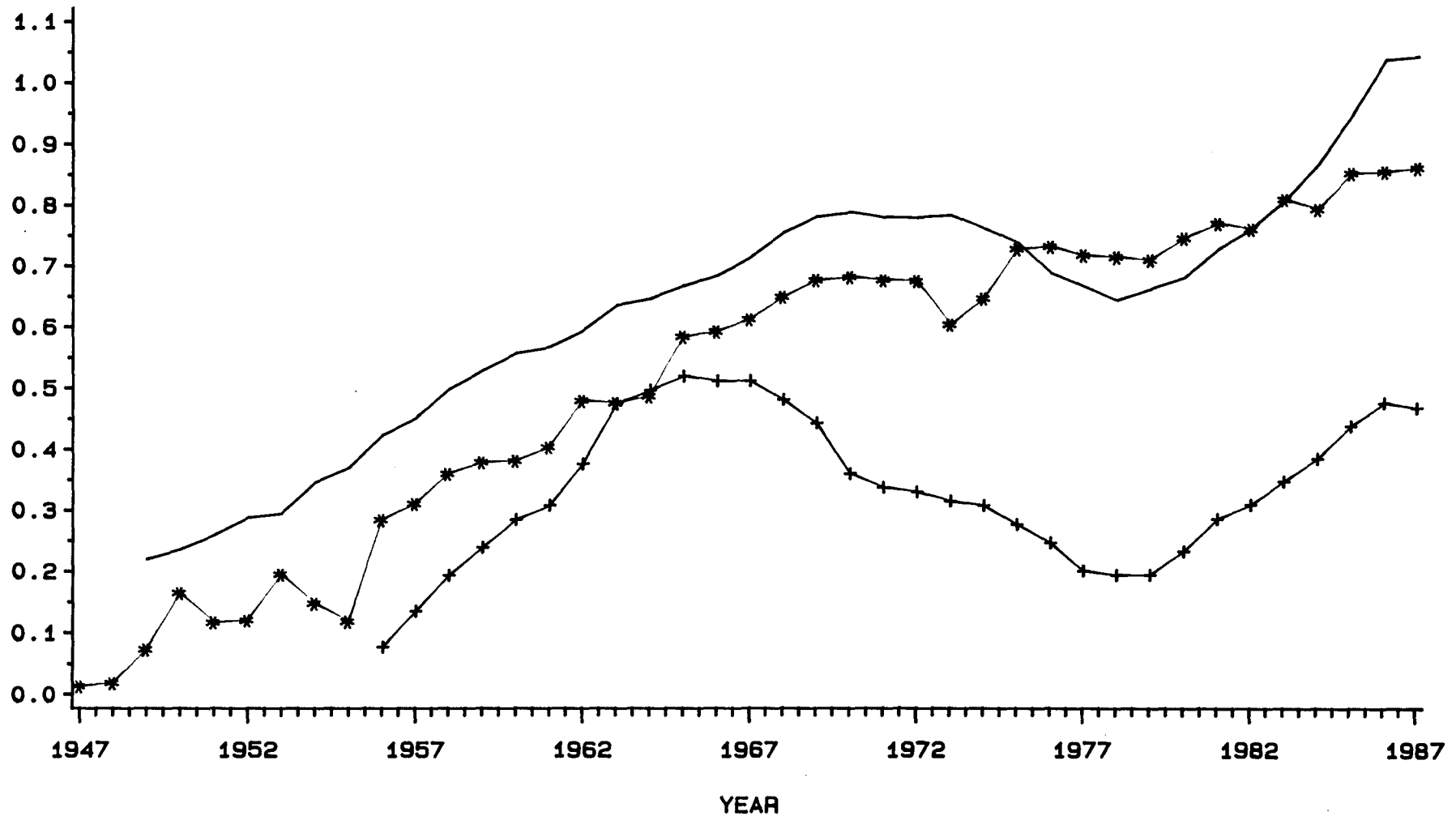
Swanson, Edward O. "Fashions in Test Scores, or What Goes Up Must Come Down?" Student Counseling Bureau Review, University of Minnesota, September 1973, Vol. 25, No. 1.

Waters, Brian K. The Test Score Decline: A Review and Annotated Bibliography, Technical Memorandum 81-2, Directorate for Accession Policy, Office of the Secretary of Defense, April, 1981.

Zajonc, Robert B. "Family Configuration and Intelligence," Science, Vol. 192, April 16 1976, 227-236.

THE PAYOFF TO COLLEGE AND ACADEMIC ACHIEVEMENT AND COLLEGE ENROLLMENT RATES

ITEDAV1



+++ ACHIEVEMENT OF JUNIORS AND SENIORS
 *** LOGIT OF COLLEGE ENROLL RATE OF WOMEN 18-19
 --- PAYOFF FOR WOMEN WITH 1-5 YRS OF EXPERIENCE

Table 1
Impact of Monetary Costs and Payoffs on the Percent of Female
High School Juniors That Attend College in 1961

Percent Attending	<u>Low</u> 11.6	<u>Low Mid</u> 22.4	<u>Middle</u> 34.4	<u>High Mid</u> 45.9	<u>High</u> 58.3
<u>Payoff Costs</u>					
Education Differential	-.0045*** (3.07)	-.0037*** (3.27)	.0036** (3.12)	.0049*** (2.84)	-.0009 (.50)
Occupational Differential	.0007 (.68)	.0039*** (4.89)	.0035*** (4.36)	.0030** (2.54)	.0035*** (4.76)
<u>Time Costs</u>					
Foregone Earnings	-.0009 (.58)	.0037*** (2.97)	-.0038*** (3.06)	-.0063*** (3.51)	.0009 (.48)
SMSA Unemployment Rate	.40 (1.50)	.44** (2.22)	.72*** (3.43)	1.87*** (6.26)	-.67** (2.24)
<u>Out of Pocket Costs</u>					
Tuition + Room + Board at Cheapest Col	-.0216 (3.52)	-.0067 (1.48)	-.0365 (8.16)	-.0060 (.92)	-.0417 (6.12)
Additional Costs at Cheapest 4 Yr College	-.0046 (1.07)	-.0064** (2.21)	-.0191*** (6.12)	-.0087* (1.75)	.0054 (1.00)
Instate Tuition at 4 Yr. Public College	-.0106* (1.66)	-.0194*** (4.02)	.0030 (.66)	-.0404*** (5.92)	.0234*** (3.15)
Distance to Cheapest College	-.072 (.51)	-.280* (2.83)	.05 (1.11)	-.022* (1.65)	.795 (5.48)
Additional Distance to 4 Yr. College	-.193* (1.87)	-.100 (1.24)	.045* (1.97)	-.022* (1.88)	.098 (.70)
Admission Cutoff Percentile at Lowest Cost College	.005 (.16)	.130 (5.80)	.10 (4.55)	.006 (.18)	.020 (.62)
Diff betw Admission Cutoff at 4 Yr. Coll & Cheapest College	.034 (1.06)	.176 (7.44)	.045 (1.97)	.087 (2.70)	.140 (4.01)
\$500 Inc. in both Payoff Measures	-1.90	.10	3.65	3.95	1.30
A \$200 Reduction in Tuition Levels	6.44	5.22	6.70	9.28	3.66
R ²	.159	.202	.212	.330	.273
Number of Observations	3923	7742	9474	4283	4619

Table 2

Logit Models of College Attendance of Women: 1947-1975

<u>Women 18 to 19 Years Old</u>								
Dependent Variable is Logit of	<u>Payoff</u> Foregone Earnings	Log Perm. Income	<u>Cost</u> Foregone Earnings	Female Unemp. Rate	Birth Order	R ²	Standard Error of Regression	Durbin-Watson Statistic
<u>Students</u> Population	1.118* (.284)	.848* (.270)	-1.589 (2.241)			.967	.090	1.64
<u>Students</u> Population	.660 (.483)	.980* (.339)	-2.815 (2.438)	1.470 (1.578)	-.254 (.210)	.970	.090	1.46
<u>Students</u> Population	.860* (.258)	.820* (.221)	-3.827	1.663 (1.416)	-.175	.970	.087	1.46

<u>Women 20 to 24 Years Old</u>								
<u>Students</u> Population	.667* (.320)	1.636* (.327)	-4.752 (2.690)	-.359 (1.758)		.975	.101	1.48
<u>Students</u> Population	.396 (.644)	1.613* (.336)	-5.408 (3.049)	-.242 (1.803)	-.245 (.504)	.976	.103	1.39
<u>Students</u> Population	.418 (.294)	1.721* (.252)	-3.827	-.581 (1.616)	-.175	.976	.099	1.40

Table 3
College Attendance of Women

	<u>Payoff (3yr)</u> Foregone Earnings	Log Per Capita Income	<u>Tuition</u> Foregone Earn	Unempl. Rate Fem. 20-24	ITED	R2	RMSE	DW/obs
Logit of Enrollment Rate of 18/19 Yr Olds 1954-1987	1.65*** (.23)	1.03*** (.14)	-10.38*** (3.04)	2.03*** (.85)	----	.970	.084	1.17/39
	.76 (.31)	1.18*** (.13)	-5.94* (2.83)	2.73*** (.74)	.61** (.16)	.978	.072	1.59/39
Logit of Enrollment Rate of 20/24 Yr Olds 1954-1987	1.71*** (.24)	2.18*** (.15)	-17.92*** (3.16)	.97 (.88)	----	.982	.088	1.66/39
	1.50*** (.28)	2.09*** (.16)	-15.69*** (4.96)	1.24 (.90)	.20* (.15)	.982	.087	1.72/39
Logit Rate of <u>Bachelor Degrees</u> HS Grads 4-9 Yrs Before 1954-1989	1.14** (.14)	.74*** (.05)	-5.35** (1.83)	---	.05 (.05)	.992	.027	1.06

- * p<.05 on a one tail test
- ** p<.025 on a one tail test
- *** P<.005 on a one tail test

(Standard errors in parentheses)

Dependent variables: Data on college enrollment and population is from various issues of the Current Population Reports, Series p20. The number of high school diplomas and bachelors degree are from table 89, and 200, Digest of Educational Statistics and Douglas Adkins the Great Degree Machine. In the Enrollment models the real income and payoff variables are the weighed averages with weights of .4 on year t, .33 on year t-1 and .27 on year t-2. For the college graduation rate models the payoff and tuition variables are unweighted averages of for t-1, t-2, t-3, t-4 and t-5. The ITED score for the graduation rate model is a weighted average with 21 yr. olds having a weight of .5 and 22 to 26 yr. olds having weights of .1 each.

Table 4
Accounting for the Post War Growth
of Female College Attendance
Predicted Effects

	Payoff	Real Income	Tuition	Acad. Achiev.	Actual Increase
College Attendance of 18-19 Yr. Olds					
1949-69	37%	46%	-10%	26%	153%
1969-79	-6%	17%	0%	-12%	4%
1979-87	18%	9%	-14%	9%	20%
College Attendance of 20-24 Yr. Olds					
1949-69	81%	92%	-30%	9%	350%
1969-79	-15%	40%	-1%	-5%	28%
1979-87	46%	19%	-48%	4%	26%
Ratio of BA's to High School Grads 4 to 9 Yrs. Earlier					
1954-69	41%	21%	-10%	2%	64%
1969-79	-3%	12%	-1%	0%	6%
1979-89	28%	9%	-13%	0%	32%

* Calculated from Table 3. The sum of the effects of the four variables do not equal the actual percentic increases reported in column 5 for three reasons: (1) The effects interact in a multiplicative way and these interactions are not accounted for, (2) Absence of unemployment effects and (3) Random error in the model.

Table 5
 Projections of College Enrollment and Graduation Rate
 Increases Through 1995

1987-1995 Enrollment	USOE	Tuition Growth Relative to Wage Growth			Contribution of		
		4% Faster	2% Faster	No Faster	Payoff	Real Income	Test Scores
18-19 Year Olds	9.6%	14%	22%	30%	16%	8%	6%
20-24 Year Olds	13.1%	10%	37%	64%	43%	19%	2%
1989-1995 BA's to HS Grads 4-9 Yrs. Perform	13.1%	12%	18%	24%	20%	37%	0%