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Education and the Gender Gap in Earned Income

by Alison Wiltbank Brady

The literature on gender differences puts forth at least three potential explanations for gender differences in income: the human capital theory, the direct discrimination theory, and the socialization theory. Using regression analysis and aggregate U.S. figures for education and earnings yields support for the direct discrimination theory. However, the resultant model predicts a decrease in earnings for both males and females who attend some college but do not graduate. The model, therefore, indicates that discrimination does exist in the workforce and calls for further research to explain the unexpected decrease in earnings for non-graduating college attenders.

Evidence from the literature supports the notion that there is a gender gap in income. I wanted to know whether this differential is due to the human capital theory--that men simply have more of the skills which are needed in the work world, including education--or the direct discrimination theory--the jobs which women tend to choose pay less simply because women choose them. Because of this, I decided to study the effect of education on income for women. I will study the effects of education on workers as a whole, and separately for men and women, then compare the economic benefits of education for each gender.

Literature Review

Many researchers in the various fields of economics, sociology, psychology and political science have studied the issue of the gender gap for income. Most of these studies include some discussion of education, some of which are relevant to this study. Although my study examines only the human capital and direct discrimination theories, I will include discussions of articles involving the socialization theory--that women are socialized to choose certain types of jobs

which pay less--to give readers a more thorough review of the academic literature.

In a study of nine industrial nations, Donald Treiman and Patricia Roos examined the theory that the earnings differential is due to less human capital accumulated by women, including education. In six of the nine countries, including the United States, the return to education was less for women than for men, and in five of the countries the educational coefficient is not statistically different from zero. For five countries there was no evidence against the hypothesis that women receive no increase in income based on more education. Because the United States falls in the category of countries where the coefficient of women's education as an independent variable for predicting earnings is not significantly different from zero, this study would support my hypothesis that women receive less income benefit from education than men (1983).

Examining the productivity aspect of human capital, Robinson and Wunnava use a frontier approach to study the earnings-productivity differential which eliminates the need to assume that all unmeasured male and female characteristics are the same. Because of this elimination of bias,

their study is more sound than most studies of its kind, and their results should be considered credible. These results show that female earnings would be 25 percent higher per hour without direct discrimination (1989). This seems to indicate that human capital theories based on the type of education men and women receive do not account for much of the female earnings differential. Because this study was not dealing with careers involving high amounts of education, however, it may not be directly applicable to my interest in women's returns to higher education.

Robin Bartlett and Timothy Miller studied the educational aspect of human capital by gender, through executive earnings of Denison and Wellesley college graduates. Their research indicated that men made 50.7 percent more than women, despite more graduate study on the part of the women, and more prestigious study for the Wellesley graduates. When the authors substituted the sample characteristics of Denison men into the estimated regression equation as Denison women, it showed that Denison men would make \$27,225 less if evaluated by the same criteria as the women; this implies that about half of the earnings differential between the men and women could not be explained by sample characteristics (1988). This indicates that even controlling for education, discrimination against women still exists.

Using the socialization theory, Hans-Peter Blossfeld studied sexual segregation of careers in the Federal Republic of Germany. His research indicates that although there has been an equalization of men and women in educational opportunities, they are still segregated for vocational training, which limits training opportunities for women (1987). It is

possible that different areas of study may influence the benefits of education in the United States, as well. Socialization of men and women toward stereotypical majors may lead men to careers that pay more.

The idea that socialization of men and women towards different fields contributes to the income differential is supported by a study by Barry Gerhart, in which he examined gender differences in current and starting salaries controlling for college major. He found that 43 percent of the starting salary differences between males and females were due to college major. He also found that men receive higher returns to their degree level among college graduates (this is not true for the whole sample, which included non-college graduates) (1990, 424). Thus the reason women make less could be due to the fact that they choose less rewarding fields.

On the other hand, another theory about gender income differentials involves the reverse idea that *because* women are the common employees in a field, products from jobs in which women are the common employees ("women's work") are undervalued; in other words, women do not choose low paying jobs, jobs that women choose become low paying. Donald Williams and Charles Register studied this possibility versus the possibility that the products are simply of low value by examining the proportion of employees that are male compared to the earning in the occupation at that point in time. They examined variations within occupations and across regions. Their study supported the undervalued hypothesis in four of eight occupations; the others were statistically insignificant (1986). This indicates that the earnings differential is at least partially due to direct discrimination against women. It also

might indicate that women would actually receive higher returns to education if they avoided "female" occupations. In this way, the practical conclusion of the direct discrimination theory is the same as the socialization theory.

In order to examine direct discrimination, Francine Blau and Andrea Beller studied the trends in earning differentials by gender from 1971-1981. Their study shows that the disparity between female and male earnings had decreased over that decade, a positive trend for women. The results suggest that this is due to declining gender specialization and discrimination. However, they also discovered that returns of education for women actually decreased over that decade, as did employment in "male" and integrated jobs. This correlation between women in "male" jobs and earnings could support either the direct discrimination or socialization theory. Thus women with higher degrees were not only receiving less than men with similar degrees in 1981, they were also experiencing fewer gains in the income differential than they had ten years previous (1987).

Given the existing research, there are educational returns for both genders. However, these articles support the notion that women receive less income increase per year of education, perhaps making women think twice about graduate study. There is evidence that this is based partly, but not solely, on college major. Although my study will not examine college major, that should be considered in evaluating the costs and benefits of education. It also seems that this may be due at least partially to "women's work" being undervalued. I will consider these theories and their supporting evidence as I evaluate my own results; they will help me explain

the differences that show up in my data, and turn statistics into something understandable and logically supported.

Method

To analyze the effect of education on income benefits for women, I used variables for gender and education, only. Although I first planned to use job category variables, due to the aggregate nature of my data, these variables were collinear with education; therefore, they were unnecessary. As well, the regressions were powerful models without job category, according to the R squared values, which indicate the percent of variance of income explained by each model (See Table 1). The sample consists of the United States black and white full-time work force over the age of twenty-five, from 1979 to 1987.

The dependent variable, income, consists of average weekly income for full-time United States workers.

The gender variable is a simple dummy (zero/one) variable, men being assigned the number one, and women, zero. The education variables included in the final regression are the percentage of people who have attended some college and the percentage of people who have attended four years or more of college. The base case in the regression consists of those who received a high school education or less. Data was used from *Statistical Abstracts of the United States* and *Labor Force Statistics from the Current Population Survey*, both published by the United States government.

Also included in the model was a variable called year, which is basically an inflation variable to control for income data in non-adjusted dollars. The data are

recorded from year one to nine, starting in 1979 and running through 1987.

Table 1 shows the results of a regression for the whole population on earnings, accounting for gender and examining returns to education. Table 2 is a regression on the data for women only, examining income as affected by education. Table 3 shows a regression of income for men, by education. For statistical tables see the Appendix.

Results

The model was very powerful, with an adjusted R squared of 98 percent for the overall earnings regression, meaning that 98 percent of the variance in income was explained by the variance in gender, education and year that were included in the model (Table 1). The regressions for each gender, specifically, received slightly higher R-squared values of 99 percent for both the male and female education/earnings regression. Collinearity for the complete model was well within normal limits; what did exist was mainly between the year and partial college variables.

As expected, earnings for those with a college degree were significantly higher than earnings for those with a high school diploma or less. Overall, college graduates make \$665.84 more per week than those with a high school education or less.

The returns for a college degree were higher for men than women; the results indicate that men receive 69 percent more for getting a college degree than women. Women with a college degree make \$429.32 more than women without any years of college. Their male counterparts, on the other hand, make \$724.30 more per week than men without any college. This education dividend is so much larger for

men than women even though men without any college seem to make more than women without college.

Very surprising were the results for the variable indicating some, but not complete, college education. The total population regression indicated that those with some college make \$767.17 *less* per week than those with no college. Both gender specific regressions showed less weekly earnings after having some college education than with a high school education or less. And male losses with some college were more than five times higher, at \$1482.10, than female losses, at \$286.22. That difference may have something to do with the fact that women have a shorter distance to the bottom. Even without thinking about theoretical grounding, the numbers seem outrageously high--if men with some college make \$1482.10 less per week than men with only high school educations, they must be making negative money.

Theoretically, I see no reason for the results indicating that people who attend some college actually make *less* than those with no college. The population is made up of full-time workers, so current students who may accept low paying jobs would generally not be included in the data. Although there is some collinearity between year and some college, it is within reasonable limits and should not cause problems. These results are contrary to other studies where income rises steadily with increased years of schooling, as well.

Conclusion

The purpose of this study was to examine educational returns to women in the context of overall returns and returns to men. The data show unusual and

unexplainable results in that those with some college education, but no degree, make significantly less than those with no college education. However, the data do provide evidence that women receive higher incomes for college degrees than they would without them, but fewer income benefits for a college education than men. This detracts from the human capital theory and supports the direct discrimination theory.

The results of the study are significant for women thinking of pursuing graduate studies, in terms of how much they are

willing to spend for such schooling. More generally, given the degree to which economic equality secures political equality, the government should take a role, as it has historically, in ensuring that people are treated justly in the marketplace. My results, showing that wage discrimination exists after controlling for education, may contribute to the academic literature suggesting that women are not being treated justly, and therefore, may be entitled to some governmental laws or programs on their behalf.

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APPENDIX--Statistical Tables

Table 1
Unweighted Least Squares Linear Regression of Earnings

Variable	DF	Parameter Estimate	Standard Error	T for H ₀ : Parameter=0	Prob > T
Intercept	1	194.096394	32.24526995	6.019	0.0001
Year2	1	16.458521	1.31843508	12.483	0.0001
Gender	1	90.345749	3.99843539	22.595	0.0001
Per13	1	-767.169601	195.4427299	-3.925	0.0004
Per16	1	665.840846	32.63243555	20.404	0.0001

Collinearity Diagnostics (intercept adjusted)

No.	Eigenvalue	Condition Number	Var Prop Year2	Var Prop Gender	Var Prop Per13	Var Prop Per16
1	1.91112	1.00000	0.0178	0.0046	0.0702	0.0368
2	1.16596	1.28027	0.0004	0.4423	0.0080	0.2913
3	0.76378	1.58183	0.0222	0.4202	0.0095	0.6559
4	0.15914	3.46540	0.9055	0.1329	0.9123	0.0160

Model: MODEL1
Dependent Variable: EARNINGS

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value
Model	4	221107.60853	55276.90213	443.314
Error	31	3865.39147	124.69005	
C Total	35	224973.00000		
Root MSE		11.16647	R-square	0.9828
Dep Mean		306.16667	Adj R-sq	0.9806

Table 2
Unweighted Least Squares Linear Regression of Earnings--Women

Predictor Variables	Coefficient	Standard Error	Student's T	P	
Constant	156.81	16.196	9.68	0.0000	
Year	14.362	0.75783	18.95	0.0000	
Some college	-286.22	94.323	-3.03	0.0089	
College grad	429.52	26.319	16.32	0.0000	
R Squared	0.9943	Resid. Mean Square (MSE)	12.66		
Adjusted R Squared	0.9931	Standard Deviation	3.557		
Source	DF	SS	MS	F	P
Model	3	3.1038 x 10 ⁴	1.0346 x 10 ⁴	817.54	0.0000
Residual	14	177.17	12.655		
Total	17	3.1216 x 10 ⁴			
Cases Included 18					

Table 3
Unweighted Least Squares Linear Regression of Earnings--Men

Predictor Variables	Coefficient	Standard Error	Student's T	P	
Constant	386.70	33.393	11.58	0.0000	
Year	19.560	1.1663	16.77	0.0000	
Some College	-1482.1	207.93	-7.13	0.0000	
College Grad.	724.30	25.217	28.72	0.0000	
R Squared	0.9903	Resid. Mean Square (MSE)	62.01		
Adjusted R Squared	0.9882	Standard Deviation	7.874		
Source	DF	SS	MS	F	P
Model	3	8.8345 x 10 ⁴	2.9448 x 10 ⁴	474.93	0.0000
Residual	14	868.08	62.005		
Total	17	8.9213 x 10 ⁴			
Cases Included 18					