
Returns to Higher Education: United States Gender Evidence

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This paper examines the relationship between educational attainment using four levels of degrees and gender median income per capita. The analysis expands the literature by including two-year degree when examining educational attainment, and by estimating the returns to educational attainment by gender while controlling for demographic-specific variables by gender. The results find that in general a higher level of education increases median income per capita. However the results show that no degree provides a positive and significant return across all regions and across all genders. The results suggest that relying solely on national data to estimate the returns to educational attainment will not reveal the significant differences of returns to degree across regions and across genders.

Keywords: returns to education, gender, human capital

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The human capital literature has established a positive link between educational attainment and earnings. Beginning with the seminal work by Mincer (1974), many studies over the decades, using individual country as well as cross-country data, have established educational attainment as one of the most important variables when explaining earnings (i.e. Barrow 1991; Hanushek and Kimko 2000; Day and Newburger 2002). A common explanation for this relationship is that employers, recognizing the link between educational attainment and labor productivity, compensate more educated employees with higher wages. Further employers compensate employees for their informal training by paying employees higher wages for years of work experience. Returns to education and experience however may not be equal within a country. In a recent paper, Goetz and Rupasingha (2003) found that although educational attainment and experience have a positive impact on per capita income, the returns to education within the United States differ across regions and states. They suggest that the differences arise from the diverse composition of the state economies.

As first examined by Schultz (1963), human capital literature has identified educational attainment as one way to lower income inequality across genders. Much of the recent income inequality literature has focused on identifying and explaining discrimination bias using developing country or cross-country data. The results of this research have been mixed. While some studies have found that inequality is reduced as educational attainment increases (i.e. Park 1996; Sylwester 2003), others have found that an increase of skilled labor while reducing inequality may also reduce wages and therefore returns to education (i.e. Jamenez 1986; Ram 1989).

A search of the literature reveals that most recent papers using United States data estimate the marginal return between a high school degree and a bachelor's degree without controlling for gender differences. Day and Newburger (2002) expanded the literature by estimating the marginal return between a bachelor's degree and an advanced degree, however the paper did not control for gender differences. When searching the literature, we did not find a study that controlled for the four levels of degrees (high school, two-year, four-year, and masters and above) with or without controlling for gender. This study expands the literature in two ways. First, the paper estimates the returns to educational attainment for the four levels of degrees. With 27 percent of the population with a higher education degree reporting a two-year degree as the highest degree achieved beyond high school, controlling for two-year degree achievement allows for a more complete estimate of returns to higher education. Secondly, this paper estimates the return to education by gender while controlling for demographic-specific variables by gender.

This study addresses three questions. Are the gains of educational attainment equal for the genders? Does achieving a higher level of educational attainment necessarily increase per capita income? Do certain regions of the United States offer a greater gain from educational attainment than others? The remaining four sections provide evidence to support the answers to these questions. The model section discusses the model and the literature that supports the motivation for the variables used to examine the questions. The data and data sources section

discusses the data and econometric techniques used to estimate the model. The empirical results section reveals the empirical results of the estimations. The conclusion section summarizes the findings of the paper.

The Model

Following the Mincer (1974) specifications, our study regresses the per capita income by gender on educational attainment while controlling for experience and regional labor market differences. The dependent variable can be measured in two ways: gender median income per capita (Y), and the log of gender median income per capita (LY). The first measure provides a dollar value for educational attainment and the other independent variables. The second measure estimates a percent return for educational attainment and the other independent variables. Although we estimate the regression twice, once for each dependent measure, in the tables we only report regression results using the log of gender median income per capita. The advantage of using this measure is that it allows us to compare our results with previous studies as well as to compare results across the regions.

The demographic-specific variables used are educational attainment and experience by gender. Educational attainment is measured as the percent of the gender population that achieves a particular degree as the highest degree. The four degrees controlled for are high school degree (HS), two-year degree (AS), bachelor's degree (B), and master's degree or above (MA). A contribution of this paper is that it provides greater specification of educational attainment by including two-year degrees. Two-year degrees include associate degrees as well as vocational training beyond high school. Since work experience is not directly observable, median age by gender is used as a proxy.

Two geographic-specific variables are used to control for the potential diverse composition of regional and state economies. The first is population per square mile (PSM). Whether earnings must compensate for the higher cost of living as population density increases or higher earnings reflect that high-skilled, specialty jobs tend to concentrate in more densely populated locations, all have found that population density has a positive and significant impact on earnings (i.e. Rauch 1993; Ciccone and Hall 1996; Goetz and Rupasingha 2003). This implies that to some extent PSM controls for earnings differences that might arise from the correlation between industry structure and population density. A second geographic-specific variable accounts for the division of jobs between the private sector and public sector. Berger (1997) found that a greater ratio of private sector jobs to public sector jobs increased earnings. In this paper, the variable used is the percent of the county population employed by the government (GOVT).

The model relates the log of gender median per capita income (LY) to a vector of dummy variables (D) representing gender, a vector of demographic-specific independent variables (X), and a vector of geographic-specific independent variables (Z). The model is:

$$LY = D + \beta X + \gamma Z + \varepsilon$$

The model includes a dummy for male and female to allow for different intercepts for each gender. The demographic-specific independent variables included in X are:

HS: by gender, the percent that has a high school degree as the highest degree achieved,

AS: by gender, the percent that has an associate’s degree as the highest degree achieved,

B: by gender, the percent that has a bachelor’s degree as the highest degree achieved,

MA: by gender, the percent that has a master’s degree or above as the highest degree achieved,

Medianage: by gender, the median age, and

The geographic-specific independent variables included in Z are:

Public: the percent in the county employed by the government, and

PSM: the population per square mile.

Data and Data Sources

The data used is county level data for the forty-eight contiguous states and the District of Columbia and was obtained from the 2000 U.S Census. The states are divided into the four regions using U.S. Census regional definitions (Table 1).

**Table 1.
U.S. Census Regional Definitions**

Northeast Region	South Region	Midwest Region	West Region
Connecticut	Alabama	Illinois	Arizona
Maine	Arkansas	Indiana	California
Massachusetts	Delaware	Iowa	Colorado
New Hampshire	Florida	Kansas	Idaho
New Jersey	Georgia	Michigan	Montana
New York	Kentucky	Minnesota	Nevada
Pennsylvania	Louisiana	Missouri	New Mexico
Rhode Island	Maryland	Nebraska	Oregon
Vermont	Mississippi	North Dakota	Utah
	North Carolina	Ohio	Washington
	Oklahoma	South Dakota	Wyoming
	South Carolina	Wisconsin	Hawaii*
	Tennessee		Alaska*
	Texas		
	Virginia		
	West Virginia		
	District of Columbia		

*part of western region but not included in this study.

Table 2
Summary Statistics – 2000 U.S. Census data

Variable	Nation	Regions			
		Northeast	Midwest	South	West
Women					
Median earnings	15,237.18 (3,337.57)	18,100.54 (5,256.38)	15,025.94 (2,783.84)	15,265.43 (3,129.64)	14,154.29 (3,891.96)
% High school highest	55.98% (6.33)	53.90% (6.54)	59.94% (4.87)	53.16% (5.30)	56.69% (7.17)
% Associates highest	6.28% (2.13)	7.81% (2.07)	7.08% (1.94)	5.12% (1.74)	7.17% (1.88)
% Bachelors highest	10.99% (4.89)	13.46% (5.05)	11.34% (4.16)	9.55% (4.44)	13.70% (6.03)
% Masters or above highest	5.09% (2.85)	8.15% (3.58)	4.47% (2.29)	4.94% (2.68)	5.56% (3.16)
Age	38.63 (4.06)	39.12 (2.40)	39.44 (4.02)	38.19 (3.85)	37.77 (5.02)
Observations	3109	220	1055	1421	413
Men					
Median earnings	20,102.36 (3,939.53)	23,430.93 (4,893.88)	20,113.34 (3,563.47)	19,777.37 (3,613.57)	19,419.38 (4,484.10)
% High school highest	54.24% (6.98)	51.97% (7.00)	58.66% (5.62)	51.44% (6.15)	53.76% (7.10)
% Associates highest	5.11% (2.06)	6.28% (1.69)	5.93% (1.96)	4.00% (1.66)	6.24% (1.75)
% Bachelors highest	10.95% (5.15)	13.89% (5.35)	10.92% (4.26)	9.69% (5.01)	13.79% (5.80)
% Masters or above highest	6.05% (3.98)	9.27% (4.67)	5.50% (3.12)	5.50% (3.92)	7.62% (4.51)
Age	36.14 (3.97)	36.79 (2.34)	36.94 (3.34)	35.43 (3.72)	36.17 (5.18)
Observations	3109	220	1055	1421	413

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Table 2 reports the summary statistics by gender for the nation and the four regions. Per capita income is the median income per capita by gender. Based on 2000 U.S. Census data, the summary statistics reveal that not only is female income

Table 2, continued

Variable	Nation	Regions			
		Northeast	Midwest	South	West
t-test (H_0 : men = women)					
Median income	10.630***	2.626***	6.541***	6.739***	4.370***
% High school highest	-1.240	-0.379	-0.492	-0.874	0.451
% Associates highest	-7.386***	-2.186**	-3.880***	-6.146***	1.932*
% Bachelors highest	-0.112	0.3114	-0.809	0.351	0.093
% Masters or above highest	5.757***	1.2219	4.134***	2.418**	3.859***

(standard deviation); *** 1% significance; ** 5% significance; *10% significance

per capita lower for the United States and each region, the t-test results find that there is a significant difference between male and female median income per capita. The male median income per capita for the United States was \$4,865 higher than the female median income per capita or 31.9 percent higher. Among the regions, the West region had the highest difference with male median income per capita 37.2 percent higher than female median income per capita. Even the Northeast region with lowest difference still reports that male median income per capita is 29.4 percent higher than female median income per capita.

Educational attainment represents the percentage of county residents age 25 or older whose highest level of education is one of the four levels of degrees. T-test results suggest that for the nation and the four regions the percent of the population with the highest degree achieved as a high school degree or as a four-year degree is not significantly different for males and females. However, females have a significantly higher percent of the two-year degrees and males have a significantly higher percent of the master's and above degrees. This difference is likely to explain some of the median income per capita differences between the genders. Comparing the regions, the Northeast region had the highest overall percent of the population with at least a two-year degree or higher as the highest degree achieved. When comparing only higher education attainment, the Northeast leads all the regions with the highest percent of the population, male and female, attaining each of the top three levels of education. Medianage is the median age for each gender, and represents a proxy for experience.

The Empirical Results

National results

The initial regression examines the relationship between gender median income per capita and the independent variables. The coefficients for the education variables estimate how a one percent change in the percent of the population that

has a particular degree as the highest degree achieved impacts the return on gender median income per capita. To account for intercept differences between the genders, a constraint of no constant was applied. Since there may be state specific factors that impact counties within a state, but not other states, the regression accounted for these differences by the clustering of counties by state. Clustering by state assumes that the observations were independent across states, but not necessarily independent within states.

Once the regression was estimated, the results were tested for heteroskedasticity, skewness, and kurtosis using an orthogonal decomposition approach developed by Cameron and Trivedi (1990). Not surprisingly, the tests rejected the null hypothesis and the regression was re-estimated using robust estimators.

Table 3 reports the empirical results for the robust estimation of the log of median income per capita by gender equation using the 2000 U.S. Census data for all 3,011 counties. For females, the marginal return for a high school degree was not significantly different from zero. For males, although significantly different from zero, the marginal return for a high school degree was 0.16 percent or \$22

Table 3
Log of Median Income – National Results

Robust estimation	Coefficient	Std. error	t-stat
High school - male	.0015***	.0005	3.06
High school - female	-.0009	.0006	-1.45
Associates degree - male	.0053***	.0018	2.95
Associates degree - female	.0088***	.0020	4.38
Bachelors - male	.0117***	.0019	6.18
Bachelors -female	.0045***	.0011	4.02
Masters or higher - male	.0052	.0033	1.59
Masters or higher - female	.0240***	.0026	9.10
% Government jobs	-.0114***	.0005	-22.80
Population per square mile	.0013***	.000001	3.51
Men	9.805***	.0329	298.2
Women	9.621***	.0393	244.4
<hr/>			
H_0 : men degree = women degree			
High school degree	9.93***		
Associates degree	1.72		
Bachelors degree	10.67***		
Masters or higher degree	19.92***		

*** 1% significance; ** 5% significance; *10% significance

income per capita. Since Goetz and Rupasingha (2003) results using 1990 U.S. Census data, the marginal return to a high school degree declined from the 0.4 percent or an additional \$85 to median income per capita. The marginal return to a two-year degree for females was 0.88 percent and for males was 0.52 percent or what equates to an additional \$110 for female and \$87 for male median income per capita. T-test results find that these returns are not significantly different from each other.

The marginal returns for a four-year degree for males and females are significantly different. For males the marginal return is 1.17 percent and for females the marginal return is 0.45 percent. This translates to a \$263 income increase for males and a \$110 income increase for females. These results are lower than the comparable Day and Newburger (2002) marginal return of 1.75, and the Goetz and Rupasingha (2003) marginal return of 3.99. The differences likely arise because we accounted for the marginal returns to a two-year degree, and Goetz and Rupasingha (2003) did not account for the marginal returns for a master's or above degree. For males, although not significantly different from zero, the marginal return for a master's or above is 0.52 percent. For females, the marginal return is 2.4 percent or an additional \$404 to median income per capita. Day and Newburger (2002) estimated a marginal return of 2.5 percent for advanced degrees.

Mincer (1974) and others found that median age, a proxy for experience, had a positive and significant impact on a state's per capita income. However when we estimated the regression, gender median age for the United States and for each region was not significantly different from zero. Since it did not add to the analysis, median age was dropped from the regression.

As expected, a one percent increase in the population employed by the government reduces median income by -1.14 percent or reduces median income by \$184. This is slightly higher than the \$148 loss estimated by Goetz and Rupasingha (2003). In addition, the population density while increasing median income by 0.13 percent or \$26, the gain is less than the \$46 gain estimated by Goetz and Rupasingha (2003). These differences may be due to changes over the ten year period, and the control variables differ between the two studies.

Regional results

The regional regressions examine the relationship between gender median income per capita and the independent variables for the four regions of the United States. The interpretation for the education coefficients is the same. The coefficients estimate how a one percent change in the percent of the population that has a particular degree as the highest degree achieved has on the return to gender median income per capita. To account for intercept differences between the genders, a constraint of no constant was used. As before, the clustering technique is applied to account for within-state correlation. The appropriate tests were estimated and robust estimators used.

After reviewing the results in Table 4, the first observation is that in the Northeast and West regions, the return to a high school degree is either significantly negative or not significantly different from zero. This suggests that for these

Table 4
Log of Median Income – Region results

Robust estimation	Northeast	Midwest	South	West
High school - male	-0.0067*** (.0027)	0.0053*** (.0012)	0.0066*** (.0007)	0.0011 (.0017)
High school - female	-0.020*** (.0031)	0.0050*** (.0013)	0.0073*** (.0009)	-0.0057*** (.0017)
Associates degree - male	-0.010* (.0053)	0.0032 (.0023)	0.0177*** (.0022)	0.0241*** (.0079)
Associates degree - female	-0.001 (.0058)	0.0088*** (.0028)	0.0259*** (.0025)	0.0186* (.0096)
Bachelors - male	.0356*** (.0054)	0.0139*** (.0022)	0.0175*** (.0022)	0.0047 (.0040)
Bachelors - female	0.0210*** (.0101)	0.0036** (.0018)	0.0163*** (.0016)	-0.0022 (.0023)
Masters or higher - male	-0.0200*** (.0078)	0.0019 (.0034)	-0.0048 (.0043)	0.0119 (.0074)
Masters or higher - female	-0.020* (.0107)	0.0231*** (.0039)	-0.0086 (.0007)	0.0324*** (.0065)
% Government jobs	-0.002 (.0022)	-0.0128*** (.0010)	-0.0086*** (.0007)	-0.0077*** (.0015)
Population per square mile	0.000 (.0000)	0.0110*** (.0018)	0.0050*** (.0000)	0.0037*** (.0014)
Men	10.17*** (.1943)	9.571*** (.0862)	9.466*** (.0412)	9.637*** (.1138)
Women	10.76*** (.2197)	9.268*** (.0894)	9.057*** (.0534)	9.720*** (.1302)
H₀: men degree = women degree				
High school degree	12.86***	0.04	0.37	8.14***
Associates degree	1.90	2.33	5.42***	0.20
Bachelors degree	4.50**	13.01***	0.20	2.26
Masters or higher degree	0.00	17.1900***	2.41	4.10**

(standard deviation); *** 1% significance; ** 5% significance; *10% significance

regions, achieving a high school degree as the highest degree attained is not sufficient to attain the median income per capita for males or females. This is not surprising since the summary statistics reported that the Northeast and West regions had the highest percent of the population with a degree beyond high school as the highest degree achieved. For the Midwest and South regions, the return to a high school degree is positive and significant but less than one percent. When comparing these results to the 1990 national results found by Goetz and Rupasingha (2003), and Day and Newburger (2002), it suggests that while the return to a high school degree was positive and significant during the 1990s, those returns had diminished by the 2000s.

The results for the returns to a two-year degree begin to reflect the gains from higher education. For the South and West regions, the returns are positive and significant. In the South region, the return for males is 1.77 percent and for females 2.59 percent with female returns being significantly higher than male returns. In the West region, the return for males is 2.41 percent and for females is 1.86 percent. Pursuing a two-year technical degree or associates degree has a positive and significant impact on the median income per capita. Except for the return for females in the Midwest region, the return to a two-year degree is not significantly different from zero for the Midwest and Northeast regions.

The gains from higher education in the Northeast region are realized when increasing the percent of the population that has a four-year degree as the highest degree achieved. The return for males is 3.56 percent and for females is 2.1 percent. The positive and significant returns, although smaller, continue for the Midwest and South regions. T-test results suggest that the returns are significantly higher for males than females in both the Northeast and Midwest regions, but not significantly different in the South region. The returns in the West region are not significantly different from zero.

The surprising results are the returns to a master's and above degree. Except for the returns to females in the Midwest and West regions, returns are either not significantly different from zero or significantly negative as in the Northeast region. This contradicts the conventional wisdom that more education increases skills and therefore is rewarded with higher wages and the Day and Newburger (2002) results that there is a 2.5 percent return for advanced degrees. For the Northeast region, a possible explanation is that with relatively high concentration of advanced degrees for both males and females, the advanced degree does not warrant a higher return. In the Midwest and West regions, the significantly lower percentage of females with advanced degree necessitates a positive return to masters and above degree. For the South region, the returns not being significantly different from zero may be a function of relatively higher returns for two-year and four-year degrees.

An increase of the percent of government jobs lead to the expected negative return, although not significantly different from zero in the Northeast. Population density was positive and significant for all regions except the Northeast region. This may be because of the large concentration of major metropolitan cities within the Northeast region.

Conclusion

At the beginning of the paper, we posed three questions that we wanted to address with our analysis. Are the gains of educational attainment equal for the genders? Does achieving a higher level of educational attainment necessarily increase per capita income? Do certain regions of the United States offer a greater gain from educational attainment than others? The answer to the first question is no, although significant differences arise less than 50 percent of the time among the different regions and degrees. The answer to the second question surprisingly is also no. The returns to high school and two-year degrees were negative for the Northeast region. The returns to a master's and above degree were positive and significant for only females in the Midwest and West regions. For the other MA variables, the coefficients were not significantly different from zero. The answer to the final question is that it depends on the degree and the region. Returns to degree were not consistent across regions. These results suggest that relying solely on national data to estimate the returns to educational attainment will not reveal the significant differences of returns to degree across regions and across genders.

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