Bri Nordin

PS300

The Gender Wage Gap and Education

Abstract

Does the wage gap exist in careers that require higher levels of educational attainment? Research indicates that, on average, women make around 80% of what men earn. This study aims to investigate the relationship between educational attainment and the magnitude of the wage gap. Due to the differences in gender socialization, I expect to find that the wage gap persists, regardless of degree obtained. To test this hypothesis, survey data relevant to gender, education, and wages were collected, and t-tests as well as multivariate regression analysis are used. The results aren't in line with my hypothesis, instead indicating that gender and level of educational attainment aren't significant indicators of income. However, there does exist a disparity in income between men and women at the post-graduate level, which indicates that my hypothesis isn't entirely off. Further research is needed to be more conclusive about this matter.

Introduction

Fourth-wave feminism is in full-swing in 2019. At the forefront of the movement is the fight for justice against sexual assault and harassment, and closely behind is the task of ensuring pay equity. The wage gap between men and women is a prominent issue that spans the entire globe. Since the 1980s, significant strides have been made in closing the gender wage gap in the United States, however progress stalled in the mid-1990s and the decrease in the gap hasn't been equal for all women. The gap between male and female college graduates decreased at a lower rate than it did for women country-

wide (Eide, 1994, p. 1). Not only does this have serious implications for the women involved, the wage gap also negatively affects the country as a whole: studies show that wage parity would halve the poverty rate for working women, the number of children living in poverty would decrease, and government spending (state and federal) on welfare programs like Temporary Assistance to Needy Families (TANF) would also decrease (Milli, Huang, Hartmann, & Hayes, 2017, p. 1).

People go to college for numerous reasons, and the decision to attend isn't one to take lightly as it requires a serious investment of time and money and will often put students thousands of dollars in debt. Besides expanding one's horizons and developing critical thinking skills, a common reason for attending college and obtaining a degree is to gain the skills necessary to work a lucrative job. It's well-documented that college degrees are worth the time and effort: in 2017, college graduates who earned a four-year degree made ~$460 more per week than those with just high school diplomas (Torpey, 2018). With the wage gap in mind, it's worth pondering how much higher that number would be if women were paid the same as men.

It's thought that men and women value different things, and that difference is what accounts for the wage gap – women take time off work to have babies and take care of the home (otherwise known as the motherhood penalty (Blau & Kahn, 2017, p. 823)), women generally choose to work in jobs that pay less, and so on – but if women receive the majority of college degrees in the United States (Blau & Kahn, 2017, p. 813), why are they, on average, paid less than men? This study seeks to explore the relationship between the gender wage gap and schooling, specifically if and how the gap changes at different levels of higher education. I hypothesize that the gap persists regardless of educational achievement.

To test this hypothesis, I collected information from a survey via Amazon Mechanical Turk (MTurk) inquiring about respondents' gender, income, and level of educational achievement. Gender

2

was broken up into six categories: man, transgender man, woman, transgender woman, genderqueer/non-conforming, and "other." For the purposes of analysis, transgender men and women were combined with their cisgender counterparts (genderqueer/non-conforming and "other" were excluded). Level of educational achievement was also broken into six categories: did not graduate from high school, high school diploma, some college but no degree, 2-year degree, 4-year degree, and post-graduate degree. Income was measured annually and broken into seventeen categories ranging from "less than $10,000" to "$150,000 or more" (an eighteenth category of "prefer not to say" was included in the survey but was excluded from the analysis). Additional questions concerning age, race, and other demographic characteristics were also asked as a means to control for other factors.

To test for a relationship between gender, education, and income, t-tests as well as multivariate regression were used. A t-test was conducted to test the relationship between gender and income at every level of educational attainment, while multivariate regression was conducted with and without control variables to identify which relationships are significant. The results of the t-test are mostly insignificant, however there is a significant disparity in income between men and women at the postgraduate level. The results of multivariate regression analysis indicate that gender and income aren't good indicators of income, however college GPA *did* have a significant relationship with income. Prior to controlling for age, college GPA, and race variables, level of educational attainment had a near-significant relationship with income, however this significance was diminished once control variables were accounted for. Ultimately, level of educational attainment and gender don't appear to affect income as much as college GPA does, meaning a bachelor's degree isn't as significant to income as a 4.0 GPA might be.

Literature Review

Studies concerning the wage gap are numerous, and many come to the same conclusion: that women earn ~80% of what men earn (Blau & Kahn, 2017; Petersen & Morgan, 1995; Hegewisch, Liepmann, Hayes, & Hartmann, 2010; Hegewisch, 2018; Rose & Hartmann, 2018). One study by the Institute for Women's Policy Research (Hegewisch et al., 2010), however, indicates that 80% isn't static across all occupations: by breaking the workforce into three categories – low-skill, medium-skill, and high-skill – the wage gap between men and women becomes more nuanced.

"Low-skill" occupations are those that that require short-term, on-the-job training of no more than a month; "medium-skill" occupations require on-the-job training of more than a month and/or some college, but not necessarily a degree; and "high-skill" occupations are those that require, at minimum, a four-year college degree. Across low-, medium-, and high-skill occupations, women earned 73.8%, 79.8%, and 66.9% of men's wages, respectively. Relative to my study, women earning 66.9% of men's wages in high-skill jobs seems to suggest that higher levels of educational achievement do not lessen the wage gap; indeed, higher levels of education may *increase* the gap.

Other studies seem to confirm the idea that higher education widens the gap: a 2001 study from *Empirical Economics* indicates that women with a university degree only earn 60% of men's wages (Garcia, Hernandez, & Lopez-Nicolas, 2001, p. 150). What could potentially be a factor in the higher-education wage gap is the choice of college major (Blau & Kahn, 2017, p. 813).

Aside from determining the magnitude of the gender wage gap, others have sought to explain *why* women earn less than men. A study in the *American Journal of Sociology* identifies three different types of discrimination that may contribute to the wage gap: allocative discrimination, valuative discrimination, and within-job discrimination. Allocative discrimination can colloquially be known as gender segregation, or the dominance of one gender in a particular occupation – women are generally

allocated to jobs that pay lower wages, and this could be due to differential access to jobs (meaning the job a woman is assigned when she's hired) and/or through subsequent promotions (Petersen & Morgan, 1995, pp. 329-330). Valuative discrimination is the amount of value placed on occupations that are predominated by women. Also known as comparative worth, the value of jobs held primarily by men is higher than those held primarily by women (Petersen & Morgan, 1995, p. 330). Within-job discrimination is lower wages being assigned to women within a given occupation within a given establishment (Petersen & Morgan, 1995, p. 330).

Gender segregation is pernicious and may, in fact, explain most of the wage gap (Petersen & Morgan, 1995, p. 345). "White-collar" jobs are predominated by men (Petersen & Morgan, 1995, p. 355), and a study by *European Sociological Review* found that the wage gap in "white-collar" jobs is more than twice the gap for "blue-collar" jobs (Hultin & Szulkin, 2003, p. 150). The same study also found that management plays a large role in the wages that women make – male managers are less inclined to challenge institutionalized gender discrimination (Hultin & Szulkin, 2003, p. 146). In fact, in establishments with greater proportions of men among managers, the wage gap is wider than in establishments with no male managers (Hultin & Szulkin, 2003, p. 150). In establishments with no male managers, the gap for "blue-collar" employees is roughly zero, and around 7% for "white-collar" employees (Hultin & Szulkin, 2003, p. 150). Ultimately, the more women working in a given occupation, the lower the wages; to tie this back to the college education wage gap, this relationship has been found to be the strongest in high-skill careers such as medicine and law (Hegewisch et al., 2010, p. 1).

Finally, other researchers have determined that socialized traits and stereotypes may contribute to the wage gap: it's been found that women are less likely to negotiate their wages than men (Blau & Kahn, 2017, p. 836), that men are more competitively-inclined than women (Blau & Kahn, 2017, p. 843), men value money and work more than women do (Fortin, 2008, pp. 909-910), and women feel less entitled to higher wages than men (Fortin, 2008, p. 910). Indeed, even the allocation process of jobs is

influenced by gender stereotypes about "men's work" and "women's work" (Hultin & Szulkin, 2003, p. 145).

While these studies are comprehensive, they have their shortcomings: current estimations of the wage gap only consider full-time, year-round employees. Between 2001 and 2015, only 28% of women and 59% of men met these qualifications; if all workers were taken into consideration, the wage gap is actually much larger (Rose & Hartmann, 2018, p. 1). Additionally, where productivity, education, and differences in the labor market fail to explain the gap, gender discrimination is assumed (Blau & Khan, 2017, p. 832), and there currently isn't a way to test for gender discrimination. Altogether, the evidence presented supports my hypothesis that the gender wage gap persists, even at higher levels of education; it may even suggest that the wage gap expands as a woman continues her education.

Data & Methods

Research Design

To collect data, a survey was administered via Amazon's Mechanical Turk (MTurk), a service that compensates users for responding to surveys. The survey included questions pertinent to research being conducted by my classmates. Questions relevant to my research inquired about the respondents' gender, income, level of educational attainment, and other characteristics (such as age and race) to serve as controls. There were 190 respondents, but due to the nature of this study, only 183 respondents were analyzed. In the case of this study, there are two independent variables (level of educational attainment and gender) and one dependent variable (income). Education and gender were determined by asking the questions, "what is the highest level of education you have completed?" and, "what is your gender?", respectively. Income was determined by asking the question, "thinking back over the last year, what was your total family income?"

Gender (coded: *gender*) was broken into seven categories: male, female, transgender man, transgender woman, genderqueer/non-conforming, and "other." For the purposes of this analysis, the transgender identities were combined with their cisgender counterparts and genderqueer/non-conforming and "other" genders were excluded. Male and female variables were coded as 1 and 2, respectively.

Level of educational attainment (*education*) was broken into eight categories: did not graduate high school (*nograd*), high school diploma (*hsdip*), some college but no degree (*somecollege*), 2-year degree (*twoyear*), 4-year degree (*fouryear*), and postgraduate degree (*postgrad*). *Education* was coded 1-8 (1 being "did not graduate high school" and 8 being "postgraduate degree"). An additional variable of "college graduate" (*collegegrad*) was added that encompasses all variables *twoyear* and up.

Income (*income*) was broken into seventeen categories (with an eighteenth added for those who preferred not to disclose their income) ranging from "less than $10,000" to "$150,000 or more," coded 1-17 (18 being excluded from the analysis). Intermediate income amounts were separated into increments of $5,000 (up to $50,000), $10,000 (up to $100,000), $20,000 (up to $120,000), and $30,000 (up to $150,000). The controls present for this analysis are race (*race*), age (*age*), and college GPA (*gpa*). For the purposes of analysis, *race* was turned into a dichotomous variable representing white and non-white respondents.

Prior research indicates that race impacts income (Hegewisch & Williams-Baron, 2018, p. 2), so controlling for it in multivariate regression can confirm or disprove this relationship. Someone's age can have an effect on income and level of educational attainment: as somebody gets older and remains in the same job, they have more opportunities for raises and promotions than somebody who's been at a job for just a year; and people who are older have been given more opportunities to pursue higher education than somebody who has just graduated high school. While level of educational attainment

can possibly affect income, it also makes sense to control for GPA as that could indicate a person's work ethic (which could lead to raises and promotions in the future).

Statistical Analysis

To analyze the data, I used a statistics program called Stata to run t-tests as well regression analyses. A t-test was performed for each level of education, allowing me to compare the mean income for men and women at each level. The mean income for each gender, the difference between the means, and the p-value were recorded for each t-test. Multivariate regression analysis was used to account for control variables and determine how much variation in income can be attributed to them. The p-value for each variable was recorded, as well as the coefficient of determination (r^2). P-values (probability) are compared against a significance level of $\alpha=0.05$; those less than 0.05 can be considered significant, meaning the correlation isn't occurring by chance.

Results

The t-test results (summarized in **Figure 1**) indicate a disparity in mean income for men and women at each level of education, although the only difference that is significant (p-value < 0.05) is at the postgraduate level. In comparing the mean incomes, a negative difference indicates that the mean income for women was higher than the mean income for men (and vice versa for positive differences). The mean incomes ranged from 1 (less than $10,000) to 12.333 (around $70,000-$79,999). Interestingly, the differences are not all positive. At the levels of *nograd*, *somecollege*, and *fouryear*, the difference is negative, meaning the mean income for women was greater than it was for men, contrary to my hypothesis. The only significant difference, however, is at the postgraduate level: women made 3.666 points (~$15,000-$20,000) less than men, and there's less than a 1% chance that this occurred at random.

Figure 1

$$H_0: \mu_{Male} - \mu_{Female} = 0$$

$$H_1: \mu_{Male} - \mu_{Female} > 0$$

T-Test	Mean Income by Education Level							
Gender	N/A	collegegrad	nograd	hsdip	somecollege	twoyear	fouryear	postgrad
Male	9.086	9.226	1	8.4	9.2	7.2	8.514	12.333
Female	8.978	8.95	11	5.75	9.48	6.833	9.848	8.667
Difference	0.108	0.276	-10	2.65	-0.28	0.367	-1.334	3.666
P-Value	0.4382	0.3574	N/A	0.2108	0.5666	0.4175	0.9202	0.0072
No. Obs	183	122	2	9	50	22	70	30

Multivariate regression analysis (summarized in **Figures 2** and **3**) gave me some insight into how other variables – age, race, and college GPA – affect income. In looking at how gender and education affect income (**Figure 2**), the coefficient of determination (r^2) indicates that less than 1% of variation in income can be explained by a combination of my two independent variables. As was the case with the correlation analysis, gender has a negative coefficient (-0.103), indicating that women make less than men (as the basis for comparison is men). Before controlling for other variables, education has a nearly significant relationship with income (p-value = 0.094), with a coefficient of 0.474 (for every unit increase in education, income increases by 0.474%).

When control variables are thrown in (**Figure 3**), r^2 increases to about 2%. Gender continues to have a negative correlation with income, but the coefficient almost doubles (-0.208) meaning the negative relationship between gender and income is somewhat stronger, however this relationship is insignificant with a p-value of 0.770 once controlled for other variables. Race, too, has a negative r^2 (-0.917), indicating that nonwhite respondents make less than white respondents do (race was coded white:1 and nonwhite:2). While education previously had a nearly-significant relationship with income, its p-value increased past the point of significance (0.515). The only control variable to have a significant

relationship with income was college GPA, which had a p-value of 0.029 and a coefficient of 0.656. For

every unit increase in college GPA, there is an increase in income of 0.656%.

Figure 2

```
. regress income gender education
```

Source	SS	df	MS			
Model	62.6207273	2	31.3103637	Number of obs	=	183
Residual	3937.18255	180	21.8732364	F(2, 180)	=	1.43
				Prob > F	=	0.2417
				R-squared	=	0.0157
				Adj R-squared	=	0.0047
Total	3999.80328	182	21.9769411	Root MSE	=	4.6769

income	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
gender	-.1026426	.6915512	-0.15	0.882	-1.467233	1.261948
education	.4735491	.2810792	1.68	0.094	-.0810851	1.028183
_cons	7.146802	1.631181	4.38	0.000	3.928106	10.3655

Figure 3

```
. regress income gender education age race1 gpa
```

Source	SS	df	MS			
Model	174.118522	5	34.8237044	Number of obs	=	171
Residual	3525.05107	165	21.3639459	F(5, 165)	=	1.63
				Prob > F	=	0.1548
				R-squared	=	0.0471
				Adj R-squared	=	0.0182
Total	3699.16959	170	21.7598211	Root MSE	=	4.6221

income	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
gender	-.2084845	.712424	-0.29	0.770	-1.615127	1.198158
education	.2279773	.3498042	0.65	0.515	-.4626921	.9186468
age	.0311446	.0338041	0.92	0.358	-.0355998	.097889
race1	-.9174435	.788842	-1.16	0.246	-2.474969	.6400821
gpa	.6558165	.2980215	2.20	0.029	.0673893	1.244244
_cons	5.874126	2.606357	2.25	0.026	.728016	11.02024

Conclusion

This study has argued that the gender wage gap persists at higher levels of education, and that it may actually increase in magnitude with more schooling. The rationale behind this hypothesis is that socialized differences – what we value, what we choose to study in college, what career we go into, and so on – are the largest contributing factor to the gap rather than outright discrimination.

Based on the results of my t-tests, I must accept the null of no relationship at each level of educational attainment except for at the postgraduate level, for which I can reject the null hypothesis and accept the alternative hypothesis. This doesn't necessarily conclude that women make less than men, however, it just means that the mean income for women at the postgraduate level is less than the mean income for men at the postgraduate level; this doesn't consider the type of work being performed, potential promotions or raises, or any other variable that could affect income.

While there was a significant difference between mean incomes at the postgraduate level, the conclusion that I can draw from my correlation analysis is that gender and education are both poor predictors of income. With that said, education approached significance, indicating that it's a better income predictor than gender is. Correlation analysis also illustrated a slightly negative relationship between gender and income.

Multivariate regression analysis corroborated the negative relationship found between gender and income, and also revealed a negative relationship between race and income. The coefficient of determination (r^2) for race was greater it was for gender, suggesting that race has a bigger impact on income than gender does. Neither of these relationships were significant, however; there's a 77% chance that gender predicting income occurs by coincidence while this chance is only 25% for race. GPA proved to be the only significant predictor of income, however the relationship was relatively weak with income increasing less than 1% for each unit increase in GPA.

11

Contrary to my hypothesis, gender and education don't have as large of an impact on income as I had thought they would. With that said, these results don't indicate that the wage gap *doesn't* exist. Rather, they suggest that other factors may be at play that determine why the gap exists. Further studies should be done to more closely investigate the relationship between gender and wages, as women making less than men puts them at a comparative disadvantage economically. If gender segregation (defined in the literature review) is to blame for the wage gap, steps must be taken to integrate the labor force. Gender segregation keeps women and men from entering fields that best suit their strengths and expertise, negatively impacting society as a whole.

While this study has its strengths, there are a handful of ways it could be improved given sufficient time and money. First and foremost, the sample size is very small with less than 200 respondents (which I had to further narrow down for analysis). A larger number of respondents would be a more representative sample and would likely yield results more closely resembling what other studies have found.

MTurk itself is somewhat biased and imperfect. Respondents are primarily from the United States (the second-largest population of respondents are from India), and it's also been shown that most MTurk respondents are college-educated, usually with a bachelor's degree (Ross, Zaldivar, Irani, & Tomlinson, p. 2). Regarding US respondents specifically, most MTurk respondents are highly educated, from a low income bracket, and most US users are women (Ross et al., p. 2) (however the results of this study are generally evenly distributed between genders).

While men and women are equally represented in the survey (52% and 48% of respondents), the results skew white and well-educated. A staggering 72% of respondents were white, and 67% of respondents that I analyzed were college-graduates. I had almost no data on people without college experience, as only 6% of respondents had a high school diploma or less. Additionally, the way the

question regarding income was worded likely affected results. The question inquired about total *family* income rather than the total income of the individual respondent. This could potentially explain the outlier that is the income level of the female respondent with no high school diploma. Since the survey respondents were overwhelmingly college-educated, I had no way to determine if making the jump from a high school diploma to a 2 or 4-year degree made a significant impact on income.

Finally, while age was used as a control in the regression analysis, exclusion of certain age ranges may have simultaneously hurt and helped analysis. Age was relatively well-dispersed with a range from 18 to 68, however it's highly unlikely that people aged 18-24 have postgraduate degrees. By keeping that age bracket in the analyses, a lot of respondents were included that haven't yet had a chance to obtain higher levels of education. However, excluding that age bracket would have decreased my sample size further by about 18%.

References

Blau, F.D. & Kahn, L.M. (2017). The Gender Wage Gap: Extent, Trends, and Explanations. *Journal of Economic Literature, 55*(3), pp. 789-865

Eide, E. (1994). College Major Choice and Changes in the Gender Wage Gap. *Contemporary Economic Policy, 12*(2).

Fortin, N.M. (2008). The Gender Wage Gap Among Young Adults in the United States: The Importance of Money Versus People. *The Journal of Human Resources, 43*(4), pp. 884-918

Garcia, J., Hernandez, P.J., & Lopez-Nicolas, A. (2001). How Wide is the Gap? An Investigation of Gender Wage Differences Using Quantile Regression. *Empirical Economics, 26*, pp. 149-167

Hegewisch, A., Liepmann, H., Hayes, J., & Hartmann, H. (2010, Sept 1). Separate and Not Equal? Gender Segregation in the Labor Market and the Gender Wage Gap. *Institute for Women's Policy Research.* Retrieved 2019 March 2 from https://iwpr.org/wp-content/uploads/wpallimport/files/iwpr-export/publications/C377.pdf

Hegewisch, A. & Williams-Baron, E. (2018, March 7). The Gender Wage Gap: 2017 Earnings Differences by Race and Ethnicity. *Institute for Women's Policy Research*. Retrieved 2019 March 18 from https://iwpr.org/wp-content/uploads/2018/03/C464_Gender-Wage-Gap-2.pdf

Hegewisch, A. (2018, Sept 3). The Gender Wage Gap: 2017. *Institute for Women's Policy Research.* Retrieved 2019 March 3 from https://iwpr.org/wp-content/uploads/2018/09/C473.pdf

Horrace, W.C. & Oaxaca, R.L. (2001). Inter-Industry Wage Differentials and the Gender Wage Gap: An Identification Problem. *ILR Review, 54*(3), pp. 611-618

Hultin, M. & Szulkin, R. (2003). Mechanisms of Inequality: Unequal Access to Organizational Power and the Gender Wage Gap. *European Sociological Review, 19*(2), pp. 143-159

Milli, J., Huang, Y., Hartmann, H., & Hayes, J. (2017, April 5). The Impact of Equal Pay on Poverty and the Economy*. Institute for Women's Policy Research*. Retrieved 2019 March 3 from https://iwpr.org/wp-content/uploads/2017/04/C455.pdf

Petersen, T. & Morgan, L.A. (1995). Separate and Unequal: Occupation-Establishment Sex Segregation and the Gender Wage Gap. *American Journal of Sociology, 101*(2), pp. 329-365

Rose, S.J. & Hartmann, H. (2018, Nov 6). Still a Man's Labor Market: The Slowly Narrowing Gender Wage Gap. *Institute for Women's Policy Research*. Retrieved 2019 March 3 from https://iwpr.org/wp-content/uploads/2018/11/C474_IWPR-Still-a-Mans-Labor-Market-update-2018-2.pdf

Ross, J., Zaldivar, A., Irani, L., & Tomlinson, B. (2009). *Who are the Turkers? Worker Demographics in Amazon Mechanical Turk*. Retrieved 2019 March 18 from https://www.researchgate.net/publication/268427703_Who_are_the_Turkers_Worker_Demographics_in_Amazon_Mechanical_Turk

Torpey, E. (2018). Measuring the Value of Education. *United States Bureau of Labor and Statistics*. Retrieved 2019 March 3 from https://www.bls.gov/careeroutlook/2018/data-on-display/education-pays.htm?view_full