LABOUR MARKET ANALYSIS

Exploring the Interactions between Education, Marital Status, and Wages:

An Analysis of the Washington State Labor Market

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Abstract

Wage gap is not a secret. We are all aware that incomes may vary based on criteria such as age, gender, education level, race, marital status, and other comparable elements. However, we could not state with absolute certainty whether salaries fluctuate based on the amount of education or marital status. Considering this, the goal of this study is to examine the factors that determine salary adjustments and their interplay. We discovered that marriage increases men's income by about 20% and that acquiring a master's degree increases pay by about 20% compared to having a bachelor's degree. Both findings are compared to our finding that a bachelor's degree raises earnings by roughly 20%. In conclusion, this study's findings indicate that salaries have a substantial effect on the individual's circumstances and even influence the interaction between quantitative variables.

Introduction

The relationship between income, gender, and education is a complex and multifaceted issue that has important implications for individuals, families, and society.

The median income for Washington state residents aged 25 and over with a high school diploma or equivalent was $44,541 in 2019, while it was $79,569 for those with a bachelor's degree or above, according to data from the US Census Bureau. This shows that having more education is associated with earning more money.

Data has also indicated that there is a gender pay inequality, with men often earning more than women. For instance, according to data from the US Census Bureau, the median salary for full-time, year-round female workers in Washington state in 2019 was $52,177, compared to $64,873 for men. This shows that there is a gender pay disparity in the state, where men typically make more money than women.

Therefore, the purpose of this study is to investigate how these variables interact and impact income in the state of Washington, with an emphasis on understanding the gender pay gap and its relationship to educational attainment.

The literature on the interaction between income, education, and gender is rich and abundant. Previous studies have established that various factors, such as education level, gender, race, and marital status, have a significant impact on earnings. However, the question of how these variables interact remains a subject of ongoing research. The study by Blau and Kahn (2017) revealed that the gender pay gap is a persistent challenge, with women earning only 80 cents for every dollar earned by men. Carnevale and Rose (2018) further demonstrated that the earning gap between those with a high school diploma and those with a bachelor's degree has grown over time, with those who hold a bachelor's degree earning substantially more than those with just a high school education.

Our study aims to contribute to this body of knowledge by investigating the wage gap in Washington state. Our findings will provide a solid foundation for our understanding of the relationship between these variables and will be a valuable addition to the existing literature on the topic. By shedding light on the complexities of the wage gap, we hope to contribute to the ongoing efforts to reduce inequality and promote equal opportunities for all.

Research questions and geographic area for context

How does wages vary by education and marital status in Washington

Insights from Exploratory Data Analysis

Based on our EDA, we discovered that individuals with a college degree tend to have significantly higher average incomes compared to those without a college degree. This suggests a positive correlation between level of education and income. However, we also found that in Washington state, women with a high school education or less tend to have slightly lower incomes compared to men with the same level of education. Additionally, the income gap between men and women with associate degrees is smaller compared to the gap between men and women with bachelor's degrees.

Furthermore, we identified several outliers in our dataset, which will be further investigated in the sample selection criteria. These findings support our hypothesis that income and education are related, but it's important to note that other factors such as race, marital status, age, and employment history can also influence income. To further understand this relationship, we recommend running descriptive statistics analysis.

Sample selection criteria

Our study utilizes data from the 2021 American Community Survey (ACS) to analyze earnings disparities based on level of education and marital status. The original dataset consisted of 78528

observations, but after cleaning and removing missing values, the sample size was reduced to 25,374. The sample includes 13773 men and 11601 women who have completed at least a high school diploma. To ensure relevance to our research question and compliance with legal regulations, we restricted our sample to individuals aged 18 and above, we restricted our sample to 20 and above hours of work in a week and 52 and above weeks of work. Also, we have multiplied the wages with the number of hours worked per week and weeks worked to calculate the total wages of an individual for an entire year. We only included individuals who report positive earnings and have earned a high school diploma or higher degree. This restriction allows us to specifically examine the earning differences among individuals with higher levels of education and by gender and would provide a more accurate estimate.

Descriptive Statistics

Descriptive Statistics

Table 1: Descriptive Statistics for Quantitative Variables

Statistic	N	Min	Median	Mean	Max
Age	25,374	18	43	43.619	93
Total Wage	25,374	10,400	136,500,000	194,774,185.28	3,222,648,000

Table 2: Descriptive Statistics for Qualitative Variables

Level	Attribute	Group by	Count	Prop	Min	Mean	Max	Median
2	Wage	Gender	11601	45.72	10400	152361463	112320000	2278640000
1	Wage	Gender	13773	54.28	260000	230498428	165984000	3222648000
1	Wage	Race	17819	70.23	10400	197701777	143000000	2604160000
6	Wage	Race	2885	11.37	1040000	246521313	168480000	2604160000
2	Wage	Race	693	2.73	748800	157110481	114400000	1953120000
8	Wage	Race	903	3.56	1081600	121326210	87360000	1627600000
3	Wage	Race	378	1.49	7800000	129349656	100880000	1302080000
5	Wage	Race	35	0.14	6500000	101328686	81120000	364000000
4	Wage	Race	13	0.05	31200000	149432000	114400000	374400000
1	Wage	Marital Status	15271	60.18	10400	227527104	164736000	2604160000
3	Wage	Marital Status	2787	10.98	1372800	171846900	124800000	3222648000

5	Wage	Marital Status	6662	26.26	52000	134207202	96304000	2278640000
2	Wage	Marital Status	353	1.39	858000	139203838	106704000	2278640000
4	Wage	Marital Status	301	1.19	2704000	151060242	105300000	1302080000
16	Wage	Education	4245	16.73	52000	115065879	90854400	2115880000
19	Wage	Education	3479	13.71	10400	143076029	108160000	1953120000
18	Wage	Education	1856	7.31	2184000	130307862	101816000	2278640000
17	Wage	Education	814	3.21	748800	120710219	93600000	1302080000
20	Wage	Education	2881	11.35	858000	137527302	111800000	1953120000
21	Wage	Education	7298	28.76	260000	235546484	174720000	2604160000

Tables 1 and 2 illustrate a variety of variables that can impact an individual's salary income. Table 1 concentrates on quantitative variables such as age and total wages, whereas Table 2 emphasizes on qualitative variables including marital status, level of education, and race. In our chosen sample, the mean Age is 44. Many taxpayers were found to be married, and the majority of taxpayers held a bachelor’s degree. The mean total wages of taxpayers in our sample were $194,774,185 per year, and the majority of our sample was composed of whites. These findings suggest that a combination of both quantitative and qualitative factors can have an impact on an individual's salary income.

Description of categorical variables:

Marital Status	**Sex**
1 – Married 2 – Widowed 3 – Divorced 4 – Separated 5 – Never married (Reference Category)	1 - Male 2 - Female (Reference category)
Educational attainment	**Race of a person**
0-15 – Primary and secondary schooling (restricted) 16 – Regular high school diploma and GED (grouped) 17– Some college, but less than 1 year (Reference category) 18 – No degree and Associate's degree (grouped) 19 – Bachelor's degree 20 – Master's degree 21 – Professional degree Doctorate degree (grouped)	1 - White alone 2 - Black or African American alone 3 - American Indian alone 4 - Alaska Native and American Indian Alaska Native and Hawaiian Native(Grouped) 5 - American Indian 6 - Asian Alone 8 - Minor Race (Some other and Two or more races (Grouped)- Reference category)

Economic Model:

Wages = f (age, education, gender, marital status, race, hours worked, weeks worked)

Econometric Model:

Log (Wages) = b0 +B1.Age + B2.Age.Age + B3.Male + B4.High School.GED + B5.No Degree.Associate Degree + B6.Master's degree + B7.Professional.Doctorate degree + B8.Bachelor's degree + B9.White + B10.African American + B11.American Indian + B12.Asian + B13.Alaska Native.American Indian.Hawaiian Native + B14.Married + B15.Divorced + B16.Widowed + B17.Separated + B18.Master's Degree.Married

Econometric Estimates

Call:

```
lm (formula = log(Total Wages) ~ Age + Age2 + Male + highsch_GED +
    no_degree_associate_degree + MS_degree + Prof_Doc_degree +
    Bach_degree + White + african_american + american_indian +
    Asian + alaska_indian_hawaiian_native + Married + Divorced +
    Widowed + Separated + (MS_degree * Married))
```

Residuals:

```
    Min      1Q  Median      3Q     Max
-9.2076 -0.3840  0.0609  0.4590  3.1922
```

Table 3: Estimated Log (Total Wages) Regression Model.

Parameter estimate	Dependent Variable: Total Wages
Constant	15.746*** (0.055)
Potential experience	
Age	0.101*** (0.003)
Age2	-0.001*** (0.00003)
Male	0.421*** (0.01)
Educational attainment	
highsch_GED	-0.087*** (0.021)
no_degree_associate_degree	0.052** (0.021)
MS_degree	0.760*** (0.032)
Prof_Doc_degree	0.857*** (0.029)
Bach_degree	0.505*** (0.021)
Race/Ethnicity	
White	0.092*** (0.015)
african_american	-0.095*** (0.033)
american_indian	-0.013 (0.043)
Asian	0.120*** (0.02)
alaska_indian_hawaiian_native	0.049 (0.055)
Marital Status	
Married	0.201*** (0.014)
Divorced	0.101*** (0.02)
Widowed	0.117*** (0.045)
Separated	-0.029 (0.047)
MS_degree:Married	-0.082*** (0.031)
Observations	25,374
R2	0.29
Adjusted R2	0.29
Residual Std. Error	0.784 (df = 25355)
F Statistic	575.781*** (df = 18; 25355)

Note. Estimates are obtained using generalized estimating equations. Robust standard errors are in parentheses. *$p < .05$. **$p < .01$. ***$p < .001$.

Results

Parameter Estimates

Our data has been used to fit a log-linear model that accounts for the observed rate and linearity of the logarithm over time. The resulting model explains 29.02% of the variability observed in the target variable, wages. Several factors influence an individual's wages, including their race, education, marital status, gender, and age. All these factors, with the exception of American Indians and those who are married but filing separately, are found to be statistically significant in the model.

Compared to some other races, the precise increase in wages of white people is about 9.61%. On the other hand, the wage premium of Asians is precisely to increase by 12.74% over some other races. Comparatively, African Americans see a precise decrease in their wages of 9.96% compared to other races, while American Indians see a precise decrease of 1.28%.

Education is also statistically significant at 5% level, with individuals who have a master's degree or higher seeing the greatest increase. People with a master's degree see a precise increase of 113.93% increase in wages compared to those with some college, while individuals with a professional or doctoral degree see a precise increase of 135.56%. People with no degree or an associate degree see a 5.38% increase in wages, while those with a bachelor's degree see a 65..81% increase compared to those with a degree from some college. On the other hand, people with only

a high school or GED degree see an estimated decrease of 9.12% in wages compared to those with some college.

After controlling for other relevant characteristics, on average married individuals see a 22.18% increase, divorced individuals see a 10.07% increase, and widowed individuals see an 12.21% increase compared to unmarried individuals. Separated individuals, however, see a decrease of 2.92% in wages compared to unmarried individuals and is not statistically significant. Males also see an increase of 52.3% in wages compared to females.

the differential between a male who is married and holds a Master's degree and a female who is married and holds a Master's degree is the difference in the log odds, which is 0.46. This indicates that a male who is married and holds a master’s degree is approximately 58.4% more likely to have a higher wage than a female who is married and holds a master’s degree, all else equal.

Lastly, the coefficient of -0.001044 for Age2 as it indicates a negative relationship between age and wage growth, which means that as age increases, the rate of wage growth decreases. This nonlinear relationship between age and earnings is often referred to as a concave relationship, where the curve of the relationship is downward facing, indicating a diminishing rate of change. This finding is consistent with the commonly observed pattern in the labor market that wages tend to grow more quickly at the start of a person's career and then slow down as they get older.

Conclusion

This paper examines wages that are influenced by a wide range of demographic and personal factors, including age, gender, level of education, race, and marital status, among others. From the paper, we could discover that age has a significant impact on a person's income growth over time. A person's income typically experiences rapid growth in the early stages of their career, before gradually slowing down with age.

Wages are not only impacted by age but also by gender. Gender also plays a role in wage determination, as studies have shown a persistent gender wage gap, with women typically earning less than men in equivalent job roles. Our analysis suggests that men experience a growth rate that is 52.3% higher than that of women.

Besides those factors, education level could also be one of the factors that can impact wages, as individuals with higher levels of education often have access to a wider range of job opportunities and higher-paying positions.

In addition, our models also show that the racial matters to wages. As the racial and ethnic minorities tend to earn less than their white counterparts, even when controlling for factors such as education and experience. This disparity in earnings persists, highlighting the impact that race can have on wages. Surprisingly, marital status can also affect pay, as married individuals have access to combined wages and benefits, resulting in higher salaries than those of single individuals. Consequently, it is essential to recognize that the relationship between married status and salaries can vary based on the local labor market and the country in question.

The conclusions we analyzed are subject to several limitations. Firstly, the results drawn from the data are for the duration of 12 months. There are other variables other than stated in the analysis that could influence wages like the migration from different states or from other country, family background. If we include these variables, the regression results would change and might even eliminate omitted variable bias.

Citation

In Puerto Rico, No Gap in Median Earnings Between Men and Women, March 01, 2022

Written by: Megan Wisniewski

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Division of Labor

Shanmathi Chandran- Worked on downloading and restricting the data. Major contribution to R codes, creating dummy variables, running VIF to for multicollinearity, and formatting the tables.
Pankhuri Taneja- Worked on multiple things including R code, for different models and excel file to compare results, editing, descriptive statistics equations, interpretation of findings, and conclusion.
Su Ting Chin- Writing the initial abstract, collaborating with Pankhuri for writing a conclusion, interpreting descriptive statistics for readers, revising papers, and checking for grammatical errors.
Rabiya Fatima- Significant contributor to the writing of Intro, Lit Review, Sample Selection, EDA, and Parameter Estimates. Took charge of editing, and submitting the final document.