## ECON 5300

## GROUP 2

**Wages After War: Do Veterans and Disabled Veterans Face Pay Gaps in Washington?**

# **Introduction: Goal of Project**

Each year, approximately 200,000 individuals complete their service in the U.S. military and transition to civilian life, becoming Veterans. Many join the military for various reasons, including education, benefits, and travel opportunities. However, only a tiny fraction of the population serves the 20 or more years required to receive retirement benefits, leaving most veterans to seek employment in the civilian workforce.

A key question is whether military service affects wages after transitioning to civilian life, particularly for Washington State residents. Military experience may confer advantages such as discipline and leadership skills, but challenges like skill transferability and employer bias may counterbalance these benefits. Furthermore, a significant portion of Veterans develop disabilities either due to injuries sustained during service or emerging later in life, which may further impact their economic prospects.

This paper examines the effect of Veteran status and service-related disabilities on wages in Washington State. Using econometric analysis, we will assess **(1) whether Veterans earn more or less than their civilian counterparts and (2) whether disabled Veterans face additional wage disparities**. By addressing these questions, this study contributes to the broader understanding of labor market outcomes for Veterans and may inform policies aimed at improving their economic well-being.

# **Data: Descriptive Statistics**

The data used in this paper is sourced from the United States Census Bureau’s website for Washington State. Our data set consisted of 81,826 observations with 286 variables related to social, economic, housing, and demographic characteristics. After cleaning the data set for missing and negative values, the observations were reduced to 37,314.

The WAGP ranges from $4 to $673,000, with a mean of $77,176, which is greater than the median, showing a typical right-skewed income distribution. However, the minimum value of $4 in annual earnings also suggests outliers in the data set. Only 1% of the observations were Veterans, with 2% on active duty, indicating that the Washington State population consists of predominantly non-veterans, 97%.

Our data set indicates that only 8% of the population have a disability, which is a considerably small ratio; this may be due to the limitations of the type of disabilities captured in the survey. The scaled responses to the limited questions in the survey pose a threat of excluding a portion of the population experiencing difficulties. It is also important to note that the study does not include Psychiatric Disabilities and Chronic Illness (*Urban Institute -* [An Opportunity for the Census Bureau to More Accurately Estimate the Disabled Population in the US)](https://www.urban.org/sites/default/files/2024-02/An_Opportunity_for_the_Census_Bureau_to_More_Accurately_Estimate_the_Disabled_Population_in_the_US.pdf)

The data ranges from 17 to 94 years in terms of age, with a median of 40 years. It is almost equally split in terms of gender, with 49% of the population being female. 53% of the sample consists of married individuals, and 74% of them have more than a high school education, both of which can be associated with the high mean and median wages in the sample.

**Data: Descriptive Statistics Table: Washington State**

**Sample Size: 37,314**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Variables* | *Minimum* | *Maximum* | *Mean* | *Median* | *Standard Deviation* |
| WAGP ($) | 4.00 | 673,000.00 | 77,176.55 | 53,000.00 | 91,675.12 |
| Not a Veteran | - | 1.00 | 0.97 | 1.00 | 0.16 |
| On Active Duty | - | 1.00 | 0.02 | - | 0.14 |
| On Active Duty in the past | - | 1.00 | 0.01 | - | 0.09 |
| DIS | - | 1.00 | 0.08 | - | 0.28 |
| AGEP (Yrs) | 17.00 | 94.00 | 41.56 | 40.00 | 14.76 |
| FEMALE | - | 1.00 | 0.49 | - | 0.50 |
| RAC1P | - | 1.00 | 0.33 | - | 0.47 |
| MAR | - | 1.00 | 0.53 | 1.00 | 0.50 |
| Less than High School | - | 1.00 | 0.04 | - | 0.19 |
| High School | - | 1.00 | 0.23 | - | 0.42 |
| More than High School | - | 1.00 | 0.74 | 1.00 | 0.44 |

# **Results: Selection of Variables and Observations**

The regression model is based on a subset of observations after removing observations with missing and negative values. The model consists of WAGP (wages) as the dependent variable and MIL, DIS, AGEP, SEX, RACE1P, and MAR as independent variables. The variables MIL have been recategorized into three categories: "On Active Duty," which combines being on active duty and training; "Active Duty in the past," which is indicative of veteran status; and "Not a Veteran," which is our reference category.

The variable DIS (disability) captures individuals with any of the six disabilities in the Survey. Including a binary variable for disability directly addresses the total effect of being a veteran and having a disability without complicating the analysis with varying scales. It can also provide more meaningful insights into the general effects of any disability for policy decisions.

The control variables include gender, race, education attainment, and marital status, which are highly correlated with individual earnings. For gender, the variable sex has been recategorized as a binary variable female, with the male being our reference category. For race, the variable RACE1P has been regrouped into a binary variable representing people of color with white individuals as our reference category. The same is true for marital status, with MAR as a binary variable for married individuals and non-married as our reference category.

For education, the variable SCHL has been recategorized into three broad categories: "Less than High School," "High School," and "More than High School." Individuals with a "High School Diploma" are our reference category, as joining the US Armed Forces is also a general requirement. This also ensures that our coefficient for veterans captures the effect on wages through veteran status and not through higher education attainment.

The model has two interaction terms: "On Active Duty \* DIS" examines the combined effect of active-duty status and disability, whereas "On Active Duty in the past \* DIS" assesses how being a veteran with a disability influences wages. These interaction terms are key in determining whether military service modifies the wage impact of a disability. In addition to these interactions, the model also includes "On Active Duty" and "On Active Duty in the Past" as variables. This allows us to separately measure how military service, on its own, affects wages compared to the combined effect of military service and disability. By including the main effects and interaction terms, we can determine whether being a veteran or currently serving in the military influences wages and whether these effects change when combined with a disability.

It is also worth noting that other factors, such as work experience, industry, occupation, and innate ability, also affect earnings, but they could not be included due to survey limitations and data availability.

# **Results-Selection of Models**

Model 1 is a standard OLS regression with annual wage income (WAGP) in dollars as the dependent variable. Each coefficient represents an absolute difference in yearly earnings associated with that predictor. For example, the OLS results indicate that being on active military duty corresponds to earning about $15,810 less per year on average compared to a non-veteran with similar characteristics. Likewise, having a disability is associated with about $19,899 lower annual income, all else equal. These adverse effects, a “wage penalty” for active-duty status and disability, are both highly significant in Model 1. In other words, veterans currently serving and individuals with disabilities tend to have substantially lower wages than their counterparts in Washington State, according to this linear model.

Model 2 uses the natural log of wages as the dependent variable instead of the raw dollar amount. This log-linear specification compresses the income distribution and allows us to interpret coefficients as proportional or percentage wage changes. An explanatory variable’s coefficient in log form shows the estimated percent difference in earnings associated with that variable. Using the WAGP log makes it easier to understand the model and improves its fit. Taking logs helps reduce discrepancies in wages and control for extreme values, which helps meet some of the assumptions needed for a linear model, like normality and constant variance. Model 2 explains more wage variation than Model 1, with R² increasing from about 0.166 to 0.286. This shows it fits the data better. However, Model 2 does not fix the problem of heteroskedasticity – the error variance might still vary across different income levels or groups. As a result, the coefficients in Model 2 are easier to interpret and more reliable than in Model 1, but the standard errors in Model 2 could still be biased if the variance is not constant. Thus, the log-linear model helps us see wage differences in percentage terms, but we still need to address the issue of heteroskedasticity in the residuals.

Model 3 builds on Model 2 using the same log-linear approach but applies robust standard errors. The key difference is that Model 3 accounts for varying degrees of error in the data. Using these robust standard errors, Model 3 gives us more confidence that our findings are reliable and not just due to incorrect model assumptions. We would like model 3 because it provides robust standard errors and enables us to understand coefficients as percentage changes while guaranteeing more precise standard errors, which results in reliable hypothesis testing. In terms of fit, Model 3 has the same R² value as Model 2 since the core regression is unchanged, but the conclusions drawn from it are more trustworthy. Therefore, Model 3 helps us feel confident about what influences wages.

All three models examine the impact of veteran status and disability on wages, but they differ in how they measure outcomes and handle statistical issues. Model 1 presents effects in absolute dollar terms; an active-duty veteran earns about $15.8k less than a non-veteran. This is informative but can be misleading when the wage distribution is highly skewed. Models 2 and 3 (log-linear) instead express effects in relative terms (percentages), telling us, for example, that an active-duty veteran earns about 30% less than a non-veteran. These percentage differences are often more meaningful because they scale with the income level and are less driven by outliers. Another advantage of log model 3 is that it fits the data better while capturing more of the wage variance. The critical advantage of Model 3 over Model 2 is robust standard errors. Model 2 and Model 3 are similar, but Model 3’s corrections mean we can trust the significance of those effects. In other words, Model 3 addresses the one weakness of Model 2 (heteroskedasticity) without sacrificing interpretability. By correcting the standard errors, Model 3 ensures that we are not over or under stating the confidence in our estimates due to unequal error variance. This makes Model 3 the most statistically sound of the three.

# **Regression Model Results: A Comparative Overview**

A screenshot of a computer

AI-generated content may be incorrect.

# **Results: Interpretation of Models**

We have three different regression models examining how veteran status and disability affect wages in Washington State. Model 1 uses a linear approach to measure annual wage income (WAGP) in dollars as the dependent variable. Models 2 and 3 use the natural logarithm of wages, while Model 3 also uses robust standard errors. All models account for factors like Age (which includes a squared term), gender, race, marital status, and education level. We use dummy variables for categorical factors like veteran status, with a category for non-veterans as the baseline and high school graduates as the reference for education categories. Model 3 reports heteroskedasticity-robust standard errors, and the sample includes 37,314 observations from Washington State. The controlled variable, Age, has a positive but decreasing effect on earnings, as shown in Model 3, where the coefficient for Age (AGEP) is about 0.178 and is highly significant with a p-value less than 0.01.

The Age squared term is -0.002, statistically significant, indicating that each additional year of age increases wages by approximately 17.8% early in one's career, with a slower growth rate as age increases. Education greatly influences wages, with more than a high school education correlating to 44.6% higher wages, while less than a high school education results in 54.5% lower salaries (p < 0.01 in model 3). Gender impacts wages as well, with women earning about 40% less than men on average. Marital status positively affects earnings, with married individuals earning around 26.3% more than non-married ones. There’s a slight negative effect for race, indicating nonwhite individuals earn about 2% less than whites. The R-squared value increases from 0.166 in the linear model to 0.286 in the log-linear model, showing the latter explains 28.6% of wage variance more effectively. In Model 1, the outcome is wage in dollars. The coefficient for current active-duty status is -$15,809.73, indicating that active-duty personnel earn about $15,810 less than comparable non-veterans, with strong statistical significance at p < 0.01. In contrast, the coefficient for previous active-duty service is negative but only weakly significant at p < 0.1, suggesting a wage penalty for former service members, though not as robust as the wage gap for active-duty personnel. The coefficient for having a disability (DIS) is strongly negative and statistically significant at p < 0.01, indicating that individuals with disabilities earn approximately $19,899.07 less than similar individuals without disabilities. The interaction term between past military service and disability (On Active Duty in the Past × DIS) has a positive coefficient of $25,437.35, significant at p < 0.1, suggesting that disabled veterans may earn more than expected based on disability alone. However, this result is less robust. In contrast, the interaction between current active duty and disability (On Active Duty × DIS) is significant, indicating that being on active duty doesn't further reduce wages for individuals with disabilities.

When we compare the log-linear models in columns 2 and 3, we see they fit the data better and show more statistically significant results for essential variables. Unlike Model 1, which uses dollar amounts, the coefficients in the log models show percentage differences, making them easier to understand. For example, the log model finds that not having a high school diploma is linked to a 54% drop in wages, while having a higher education is associated with a 45% increase in wages, findings that were less clear in the linear model because the low-education effect was not significant in dollar terms. The consistent signs of the coefficients across models build our confidence in these results. Dummy variables are interpreted based on their reference groups. For instance, married individuals earn more than those who are not married. Significant results for variables like education, gender, and marital status show that these wage differences are meaningful, not random. Interaction terms help us understand how military service and disability affect wages. Notably, the wage penalty for disability is reduced for active-duty military personnel, suggesting that being in current military service helps lessen the negative impact of a disability on earnings. However, this effect does not apply to veterans, as shown by the insignificant interaction term for disabled veterans. This highlights the need to look at variables together instead of separately, revealing important insights about the connection between military service and disability that may have been overlooked.

# **Conclusion: Application and Recommendations**

This study analyzed the impact of veteran and disabled status on wages, revealing significant wage disparities among veterans and disabled individuals compared to non-veteran civilians in Washington State. Our findings indicate a clear wage penalty for individuals currently on active duty, with active-duty personnel earning roughly 29.2% more annually than non-veteran civilians. Additionally, disability status is associated with a substantial earnings reduction, with disabled individuals earning approximately 42.5% less than their non-disabled counterparts. The interaction terms showed that veterans with disabilities might experience reduced wage penalties compared to civilians with disabilities. However, this interaction was not statistically significant and should be interpreted cautiously, as the coefficient for the interaction terms is 36.9% for veterans with disability.

Key control variables further strengthen the validity of these findings. Education emerged as a crucial predictor, as individuals with more than a high school education earned approximately 44.6% higher wages compared to high school graduates, while those with less than a high school education earned roughly 54.5% less. Gender also had a significant impact, with women earning approximately 40% less than men on average, holding other factors constant. Marital status positively influenced earnings, with married individuals earning about 26.3% more than unmarried individuals. Moreover, race analysis indicated that nonwhite individuals earn around 2% less than their white counterparts, reflecting modest yet statistically significant racial wage disparities.

Given these findings, targeted policies aimed at improving the economic outcomes of veterans and disabled individuals are essential. Initiatives such as specialized vocational training, programs to increase employer awareness, and anti-discrimination policies can help mitigate wage disparities. Further research should focus on addressing limitations like the absence of data on industry, occupation, and detailed work experience, which could enhance our understanding of wage determinants for veterans and disabled populations. Policymakers must also consider intersectional factors such as gender and education when designing targeted economic support programs.