Racial and Gender Disparities in Wages and Employment: Analyzing Trends Across Education Levels in USA (1979–2022)

Muhammad Muaviya Ijaz
Friedrich-Alexander-Universität Erlangen-Nürnberg

January 16, 2025

1 Introduction

Education plays a pivotal role in shaping economic outcomes, yet disparities in wages and employment persist in racial and gender demographics in the United States. Investigating the level of education attained is important for determining the key factors that explain the change in wages and employment ratio. This report focuses on analyzing the wages and employment-to-population ratios of Black and White men and women from 1979 to 2022, with particular emphasis on the role of the education level attained as a determinant of economic participation and earnings. To facilitate this analysis, an ETL pipeline was developed by me to integrate and preprocess data from two kaggle data sources. This pipeline transforms both the datasets across different education levels, enabling a comprehensive examination of employment-to-population ratio and average hourly wage patterns across the two groups. I have tried to answer two main questions by identifying and finding key trends in the datasets:

1. "What is the impact of education level on wages and employment ratio for men and women among black and white populations?"

2. "What is the relationship between wages and employment ratio for men and women?"

2 Used Data

The pipeline generates a SQLite database file which has the table named `wages_and_employment_data`. The analysis focuses on the period from 1979 to 2022 and uses columns that display the average hourly wage and employment-to-population ratio for men and women across different levels of education by transforming and merging the two datasets on `year` column

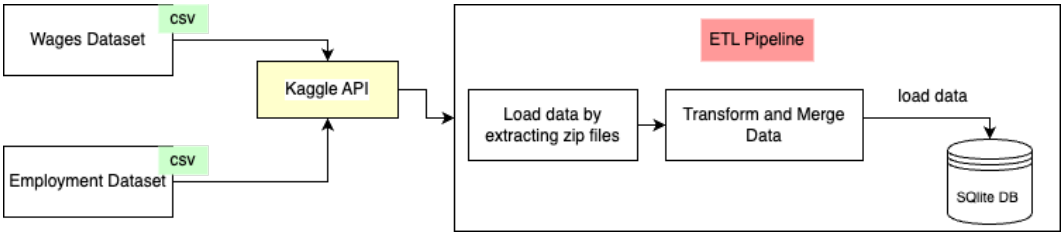

Figure 1: ETL Pipeline Flow Diagram

Figure 1 shows the ETL pipeline for the datasets. The final output after applying this transformation is a clean and transformed merged dataset stored in a table in a SQLite file with no missing and null values. The output table consists of 44 rows for all years and `66 columns`, including data on `year`, `average hourly wage`, `employment-to-population ratio` (as a percentage), and `percentage gap` for both the variables for white and black men and women, categorized by different education levels (less than high school till masters), and `mean` columns across all the education levels. Figure 2 illustrates these explained variables for various years.

	year	total_population	White_Men_Less_Than_High_School_Hourly_Wage	White_Men_HS_Hourly_Wage
0	2022	333287557	17.14	25.92
1	2021	332031554	18.13	26.03
2	2020	331511512	18.97	26.73
3	2019	328329953	17.66	25.58
4	2018	326838199	17.96	25.49
5	2017	325122128	17.82	25.14
6	2016	323071755	16.96	24.73
7	2015	320738994	17.16	24.56
8	2014	318386329	16.65	24.08

White_Women_Avg_Employment_Ratio	Black_Women_Avg_Employment_Ratio	White_Men_vs_Black_Men_Employment_Gap
51.16	54.74	1.42
49.12	53.00	2.68
52.82	57.82	1.40
52.76	58.00	1.64
52.74	57.50	1.82
52.58	56.38	2.36
52.56	55.98	3.50
52.64	55.04	3.34
52.68	54.40	4.20

Figure 2: Sample Output of Merged Dataset

2.1 Data License

The datasets utilized for this analysis are licensed under **CC0: Public Domain**, which allows for free use, modification, and distribution without any copyright restrictions. The CC0 license explicitly waives all copyright claims, granting users full rights to

use the data for any purpose. These two datasets are originally taken from the Economic Policy Institute's State of Working America Data Library, which is publicly available at https://www.epi.org/data/.

3 Analysis

For this analysis, I utilized visualization libraries i.e `Pandas`, `Seaborn` and `Matplotlib` to find key trends and patterns in the merge dataset by use of various key plots.

3.1 Impact of Education Attained on Wages

First, this study aims to explore the impact of different education levels on wages across the two groups from 1979-2022

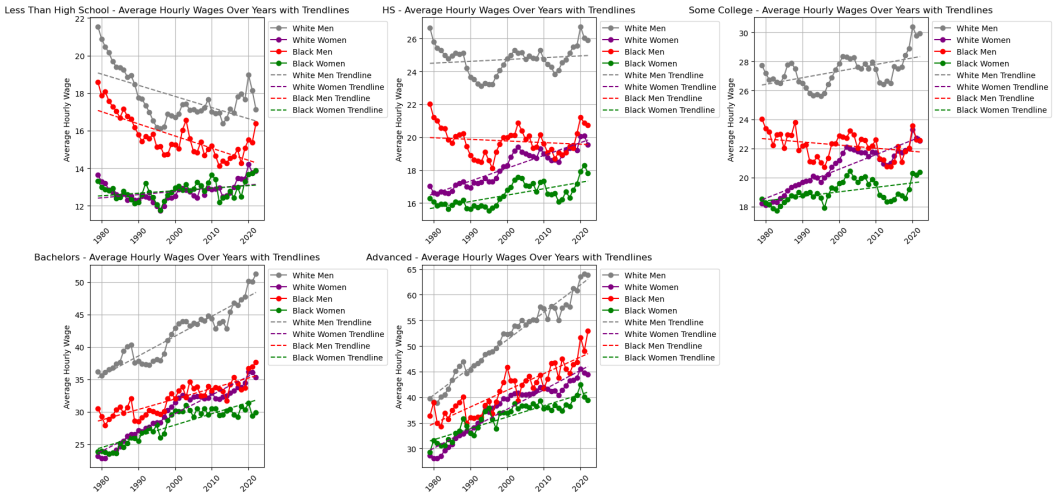

Figure 3: Average Hourly Wage of Men and Women for various education levels (1979-2022)

The above figure reveals persistent wage disparities across race and gender, with **White men consistently earning more** than all other groups at all education levels with highest hourly wage of **64 USD** with advanced degree. At the bachelor's level, White men earn on average **almost double** more than Black women. As education increases, an inrease in hourly wages is also visible and the gaps remained widened for White Men irrespective of education level, as shown with trendlines. Overall, there is a clear gap between wages of men and women with White and Black Men among the top two earners. Moreover, black women average hourly wages has seen **rise for education level greater than or equal to Bacehlors**.

Furthermore,the average hourly wages across all years were calculated for each gender and racial group. This revealed that the gap between White Men and all other groups have **increased significantly** as the years have gone by and shows signs of increasing further more in the furture, indicating a clear disaprity based on race. Overall, in terms of wages, **white population dominated the black population for each gender**. The following two plots shows this difference with and without averging wages of for all years.

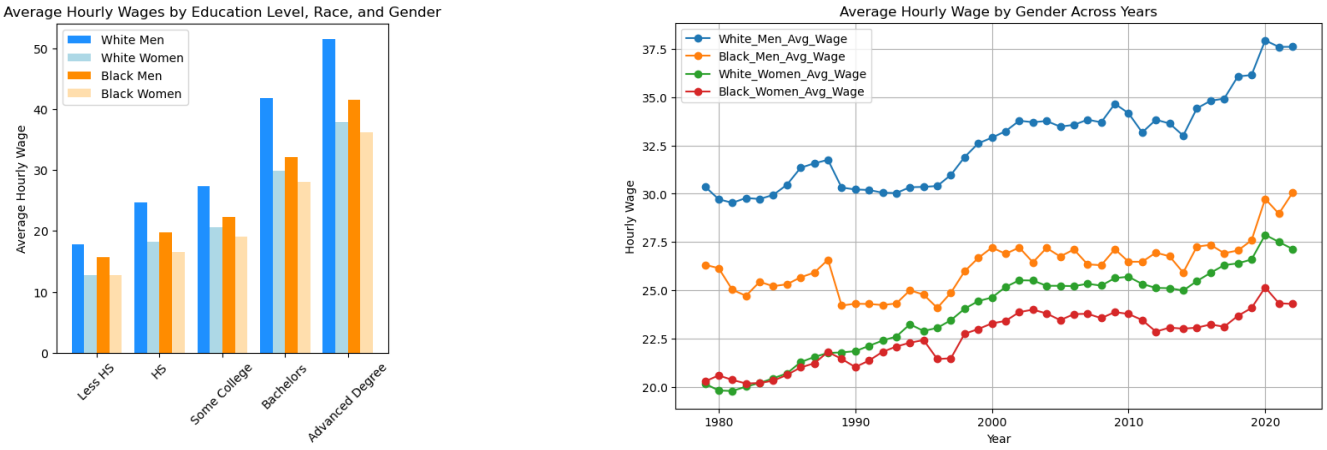

Figure 4: Average Hourly Wage of Each Gender across each year and education level

3.2 Employment Ratio vs. Eduation Level

By visualizing the trends in employment ratios across various education levels attained for each gender across the years, I observed a **decreasing correlation** in the employment-to-population ratio for each gender. Also, another key finding which is

observed with this analysis is that with a level of education equal or greater than bachelor, **black men had a higher employment ratio than white men**. Below figure demonstrates these points.

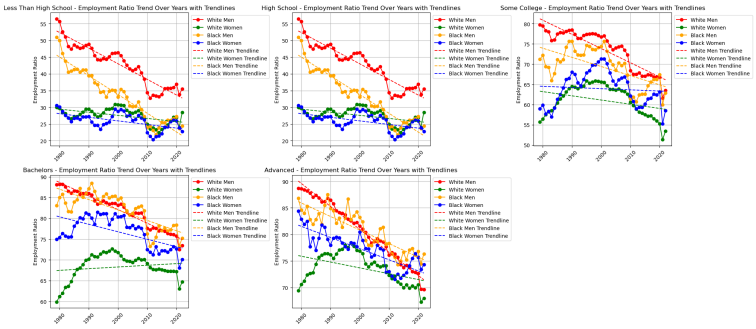

Figure 5: Employment Ratio based for each Gender based on education level(1979-2022)

Additionally, I calculated the mean employment ratio across all education levels for each year and observed that the gap **between all groups has highly decreased** in recent years. This indicates positive progress towards equality for all genders in terms of employment chances, regardless of race. However, it is important not to neglect the fact that the datasets used for this study **lacked actual population number for both genders** and hence the employment ratios derived do not fully reflect this change because of lack of data.

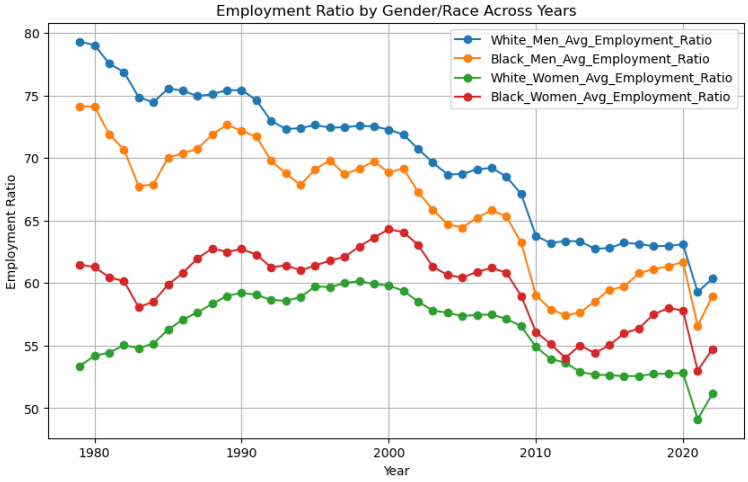

Figure 6: Employment Ratio by Gender (1979-2022)

3.3 Employment Ratio and Wage Gap between Men and Women

The wage gap between white men and women decreased from **41% to 32%**, while for Black men and women, it narrowed from **26% to 22%**. Similarly, the employment ratio gap reduced from **39% to 16%** for White men and women and from **19% to 7%** for Black men and women. Overall, significant improvement was observed with a reduction in both wage and employment ratio gaps across both the races, regardless of gender, indicating positive signs of equality in the future. This gap is shown by the plots given below

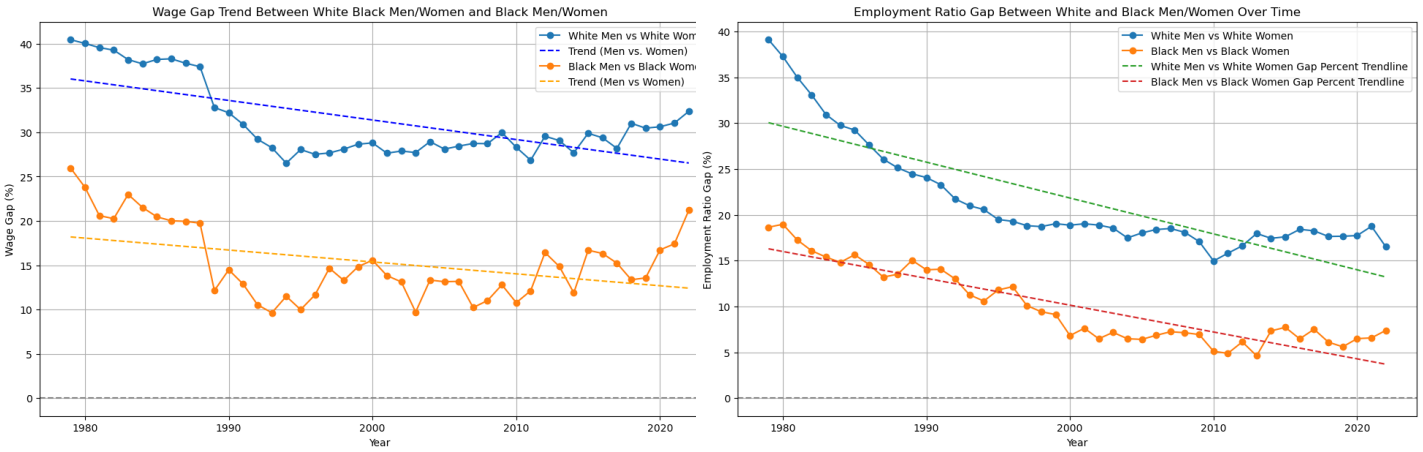

Figure 7: Reduction in Wage and Employment Gaps by Race and Gender

3.4 Correlation between wages and employment ratio

By studying the relationship between wages and employment ratio for each gender, I observed that there is a **positive increase in wages** for both the genders regardless of their race but a **decline in employment ratio** is also observed simultaneously. The final results indicate a **negative correlation between wages and employment ratios**. However, for a fully accurate interpretation, I again emphasize on the above-mentioned point that it is important to acknowledge the absence of actual population numbers for both genders in the available datasets. Following scatter and line plots along with a correlation matrix highlight these key observations.

Figure 8: Average Hourly Wages vs. Employment Ratio for White Population

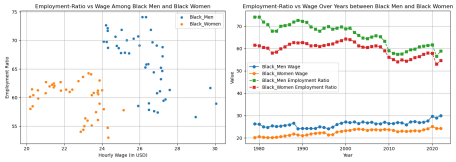

Figure 9: Average Hourly Wages vs. Employment Ratio for Black Population

The **correlation matrix** indicates a strong negative relationship between wages and employment ratios between all groups, with white and black men showing much higher negative correlation **-0.88** and **-0.64**. On the other hand, for women this coefficient was below -0.50, suggesting not so much strong evidence but still not negligible. This suggests that as wages increase, employment ratios tend to decrease with time, indicating potential inequalities, **affecting higher earners**.

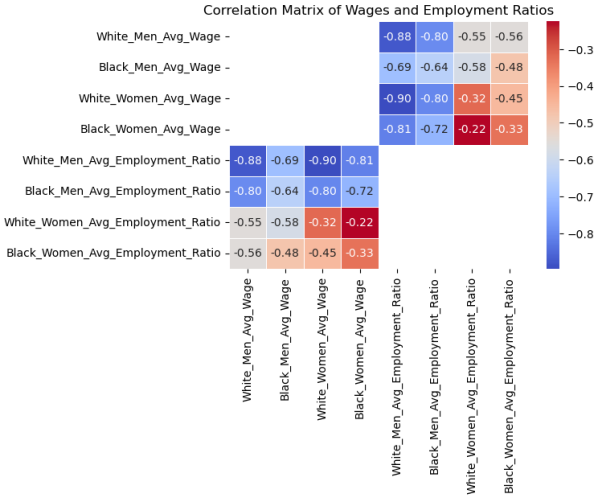

Figure 10: Correlation Matrix of Wages and Employment to Population Ratios

4 Conclusion

My analysis revealed that education levels **significantly influenced** wages and employment among men and women across both racial groups. White men consistently demonstrated the **highest average hourly wages and employment ratios** over the years. Additionally, a notable disparity in wages and employment ratios was observed between genders, with **men surpassing women in both measures** despite having similar education levels.

In recent years, however, there has been a **considerable reduction in the wage and employment ratio gap** between both the groups, suggesting progress toward greater equality. Furthermore, this study showed a negative correlation between wages and employment, with higher earners more at the risk of unemployment. However, this trend is considered to be more significant among men. In contrast, the effect is milder for women, suggesting the presence of additional factors influencing their employment ratios.

Finally, this study also addresses some **limitations**. As the datasets presented in this study didn't contain actual number for the population of both groups, it may not reflect the fully correct analysis for both the variables. To have more solid and correct outcome, these measures need to be gathered so that we see a clear picture between increase or reduction in percentages for both the variables across the two groups.