A case study of economic dynamics in the USA from the 20th and 21st centuries; median compensation, productivity and poverty level trends

Introduction:

Trends in productivity, median compensation, and poverty-level wages offer a window into the broader economic and social dynamics of a nation. Focusing on the USA, this study compares these parameters over the course of 20th and 21st centuries. These distinct time frames (1980–1990s and 2010–2020s) were chosen due to their historical and economic significance: the 1980s marked the emergence of income inequality, while the 2010s reflect an increasing focus on income equality. Moreover, I was quite interested in studying the patterns especially through the time of COVID-19 breakout (2019/2020). Through this analysis, the study aims to uncover significant trends and insights into the evolving landscape of the country, by answering the main question: ***How has productivity and median compensation affected the annual poverty level wages in the USA from two distinct time periods?*** along with the following subsequent questions:

- What are some major patterns from the 2 time periods (1980-1990 vs 2010-2020)?
- What are some major patterns based on gender for these parameters?

Used Data:

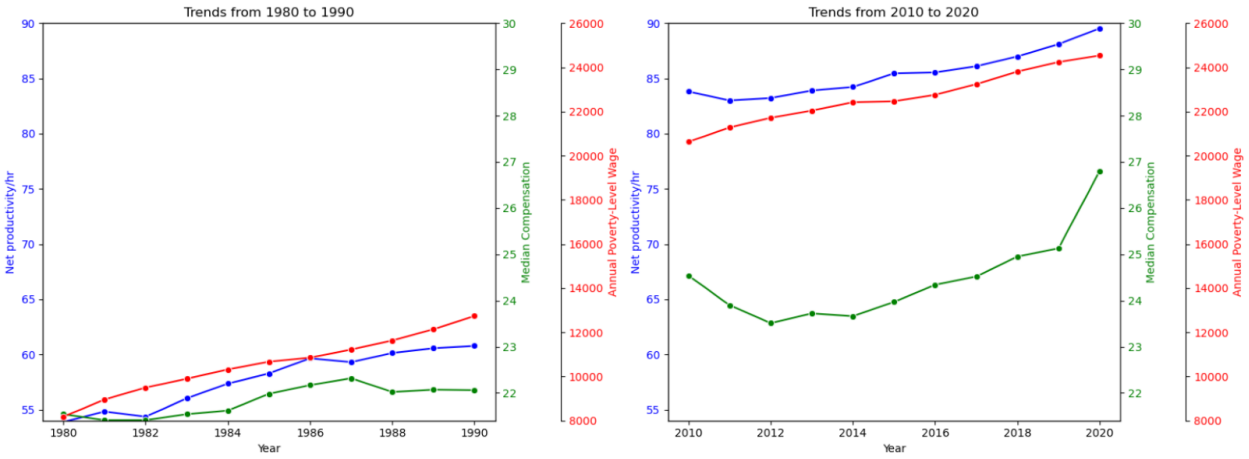
Two datasets from Kaggle, sourced from the Economic Policy Institute's State of Working America Data Library have been used to generate an SQLite database called '**productivity_compensation_and_ poverty_level.db**'. Both source datasets are licensed under CC0: Public domain which explicitly waives copyright and does not require attribution. The output data is well-structured and compact to perform comprehensive data analysis based on the question statement. The resultant table has a total of 22 rows and 12 columns, with no missing values. Firstly, it only has data from the two target time periods (1980-1990 and 2010-2020). Secondly, a brief description of the major columns is given below to better understand the domain.

Column name	Description
net_productivity_per_hour_worked (type: float)	The net value produced by an employee for each hour worked.
annual_poverty-level_wage (type: float)	The minimum annual income threshold, to classify an employee as living at or below the poverty line, in nominal (current price value, without adjusting for inflation) dollars.
median_compensation (type: float)	The middle value of the total compensation for a group of employees.

Annual poverty level wage was selected for analysis as it provides a comprehensive view of an individual's financial stability over a *full year*. Due to data limitations, I had to consider the median compensation over average compensation. The study required compensation comparison between both genders, and the dataset only had data for median compensation of men and women, and not the average data for each gender.

Analysis:

Median compensation vs Net productivity vs Poverty-level wage trends

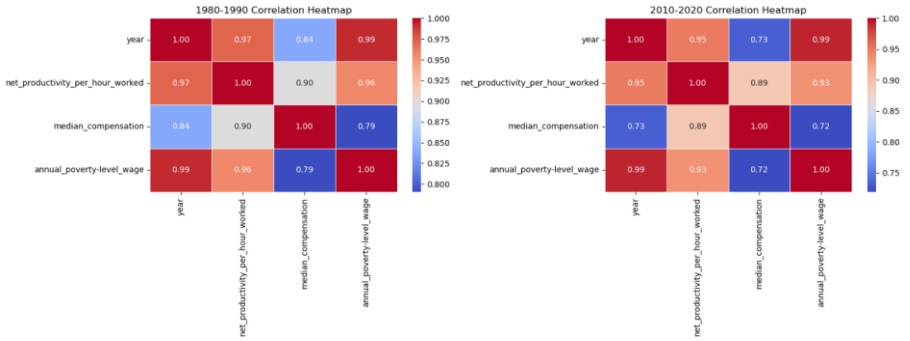


I have used Matplotlib's **line plot** to capture the patterns as it is quite simple and captures the data points in a chronological order, making it easier to observe each parameter's changes. I have specified the same scales, to get a better visual representation for both plots. Another reason for its selection is that it is ideal for these parameters which are continuous in nature.

	1980-1990	2010-2020
Annual Poverty-Level Wage	Steady increase but at a faster rate ($8000 - $12000+)	Steady and consistent increase over time (approx. $22000 – $24000+)
Net Productivity per Hour	Increasing trend (approx. 55-60) but appears more volatile compared to annual poverty-level wage	Consistent rise with less fluctuation (approx. 85-90).
Median Compensation	Initially, decreasing trend, but then increases in 1984-1987. Afterwards, remains consistent towards the end (approx. $21-$22)	Similarly, decreasing trend at the start, but then increases steadily (approx. $25-$27) with sharp rise towards the end
Key pattern(s)	Annual poverty-level wage shows a steady growth in both time periods. It always remains higher than the net productivity in the early period, indicating that rising productivity was not able to slow down the poverty levels. Except towards the end, median compensation does not diverge much from the other two parameters.	Compared to earlier decade, net productivity increases consistently with minimal fluctuations. Here, the annual poverty level remains below the net productivity, which could suggest a more stabilized economy due to employee efforts. Moreover, there is a significant difference between median compensation and the other two parameters, which suggests that it was not able keep up with rising poverty levels (compared to before where the difference is not so significant). Another interesting point is that during the COVID-19 pandemic period (2019/2020), compensation observes a sharp increase.

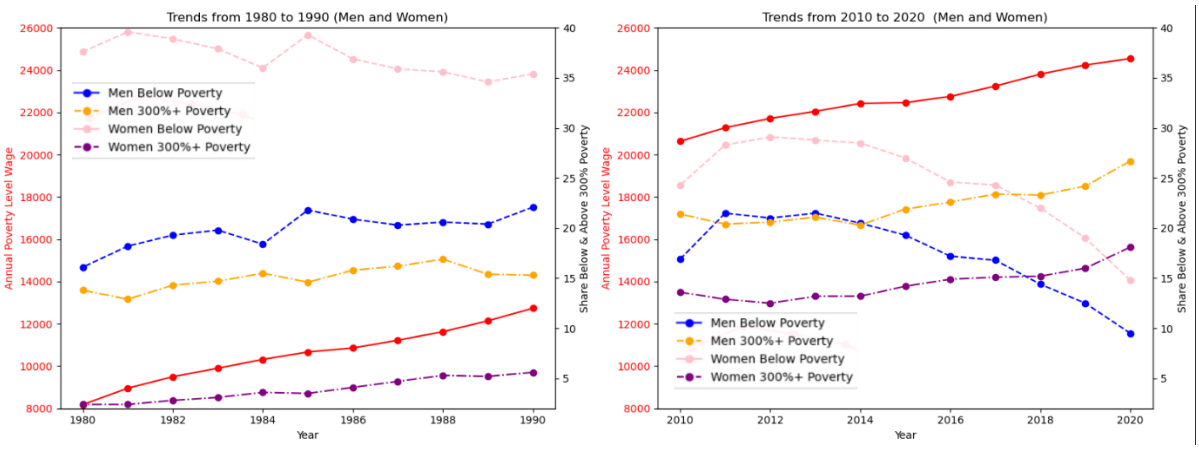
Furthermore, I have utilized a **heatmap** (shown below) to quantify the above relationships. The correlation coefficient in each cell and the color gradient shows the strength and direction of each

relationship, and their intensity, respectively. Overall, the metrics have a strong positive correlation with each other.



	Correlation Interpretation	
	1980-1990	**2010-2020**
annual poverty-level wage, net productivity per hour	Strong correlation (0.96)	Comparatively, lower correlation (0.93)
annual poverty-level wage, median compensation	In comparison (from above), weaker correlation (0.79)	Correlation dropped further to (0.72)
Insights	Poverty-level wages benefited somewhat from productivity growth, but the divergence from median compensation (at the end) could indicate that low-wage workers were not fully sharing in the economic gains (while the compensation increased, poverty levels rose as well).	This (0.72) could suggest that for many workers, the wages remained persistently low. The rising living cost overshadowed the wage growth.

Furthermore, I wanted to observe some trends between both genders in terms of these parameters, which is shown below in the line plot. The lines for share of men/women below and above 300%+ of the poverty level are shown with respect to the y-axis on the right side of the plots.



In the earlier decade, the trend for men and women below poverty levels seems a bit volatile, with ups and downs. In the mid 1980s, the numbers seem highest for them (poverty rise). The share of people 300%+ above poverty levels shows a steady constant rising trend. From the middle of the latter decade, the share of men and women below poverty levels significantly reduced (positive sign for stable economy). Whereas the people 300%+ above poverty levels (high earners) increased. Unsurprisingly, the share of women below poverty levels remains higher than that of men. However, in the latter decade, the difference reduced, which could imply a rise in income equality. The difference between the high earners remains minimal. Another interesting phenomenon is that only high women earners remained below the poverty level in earlier period, whereas, in the latter period, all categories remain below it. This suggests a significant rise in the costs of living. There was a data limitation with the annual poverty level wage, which only had a single column for it, and not separately for men and women.

Conclusion:

Based on the above analysis, during 1980-1990, productivity and compensation levels remained quite close with respect to the annual poverty levels (mostly directly proportional). In 2010-2020, economy seems to have improved as there was an increase in men and women high earners. However, a significant gap remained between poverty levels and compensation which indicates a very high cost of living in the modern time period. An interesting highlight for the COVID-19 outbreak period was the rise in median compensation (quite unusual), and no abnormality in the poverty level wages or productivity. In the latter period, it seems that employees were not compensated well according to their net output value. Overall, with increasing compensation and productivity, poverty levels also increased (i.e. poverty always remained a challenge). The analysis only partially answers the question, as it does not *fully* consider other influential economic factors like inflation, and the source datasets did not have separate annual poverty levels for men and women. Additionally, some other points may also have been missed due to focusing on median compensation instead of the average (also due to data limitation). While the findings highlight progress in addressing poverty, they also emphasize the need for more detailed research.