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 trajectory of a nation. Focusing on the United States, this study compares two critical decades; 1980–1990 and 2010–2020, to analyze key changes in the above-mentioned parameters. These time frames 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 equity. The study aims to shed light on the patterns in wage distribution, economic growth, and disparities 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, compact and narrowed down to perform comprehensive data analysis based on the question statement. Firstly, it only has data from the two target decades (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	The output (net value) produced by an employee for each hour worked, adjusted to account for costs or other deductions, to reflect the actual economic contribution.
annual_poverty-level_wage	The minimum annual income threshold, to classify an individual as living at or below the poverty line, in nominal (current price value, without adjusting for inflation) dollars.
median_compensation	The middle value of the total compensation for a group of employees. It is the amount at which half of the employees in the dataset earn more, and half earn less.

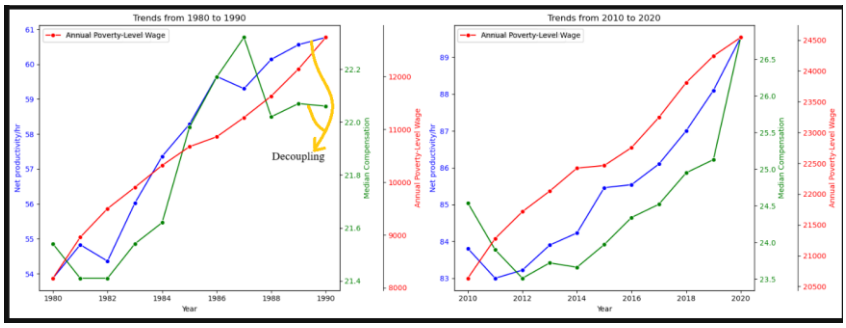
There were some columns which were kept in the output (thought to be relevant at the time of pipeline transformation) but not considered for the final analysis:

	Reason for selection
annual_poverty-level_wage vs	Annual wage was considered to better align with the standard poverty level as the poverty thresholds are generally defined based on annual income (standard representation), which provides a comprehensive view of an

hourly_poverty-level_wage (not used)	individual's financial stability over a full year. This also allows for better comparison across regions and economic systems.
average_compensation (not used) vs **median_compensation**	Ideally, I would have considered average as the main metric since the data is approximately normally distributed and does not exhibit large extremes (making it a better choice). However, due to data limitations, I had to consider the median column. 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

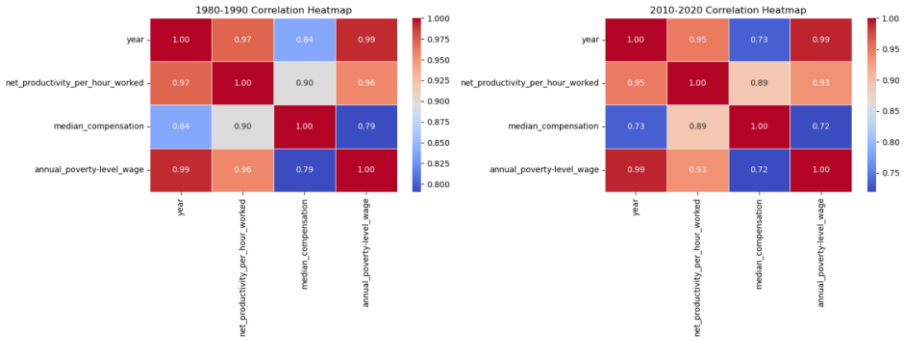


I have used Matplotlib's **line plot** to capture the patterns as it is quite simple and captures the data points in a chronological order, making it easier to observe each parameter's changes. Even though the parameters have different units (wages vs productivity), using **separate y-axes** ensures proper scaling. Another reason for its selection is that it is ideal for these parameters which are continuous in nature, showing divergence between them.

	1980-1990	2010-2020
Annual Poverty-Level Wage	Steady and consistent increase over time.	Steady increase but at a faster rate, could reflect higher inflation rates or rising living costs.
Net Productivity per Hour	Increasing trend but appears more volatile compared to poverty-level wages.	Consistent rise with less fluctuation. This could reflect steady improvements in economic efficiency.
Median Compensation	Slow growth and even a slight decline around the mid-80s before rising again. The slow growth contrasts with the steady rise in the other two, potentially hinting at *stagnation in wages*.	Steadily increases but remains noticeably lower than the other two. While workers are being compensated more, their wages are *NOT* keeping pace with productivity levels.
Key pattern(s)	Significantly wide gap between: -poverty-level wage and compensation mostly. -net productivity and compensation (80s end).	There is *parallel growth* in all 3 metrics. Poverty-level wage appears more consistent with the

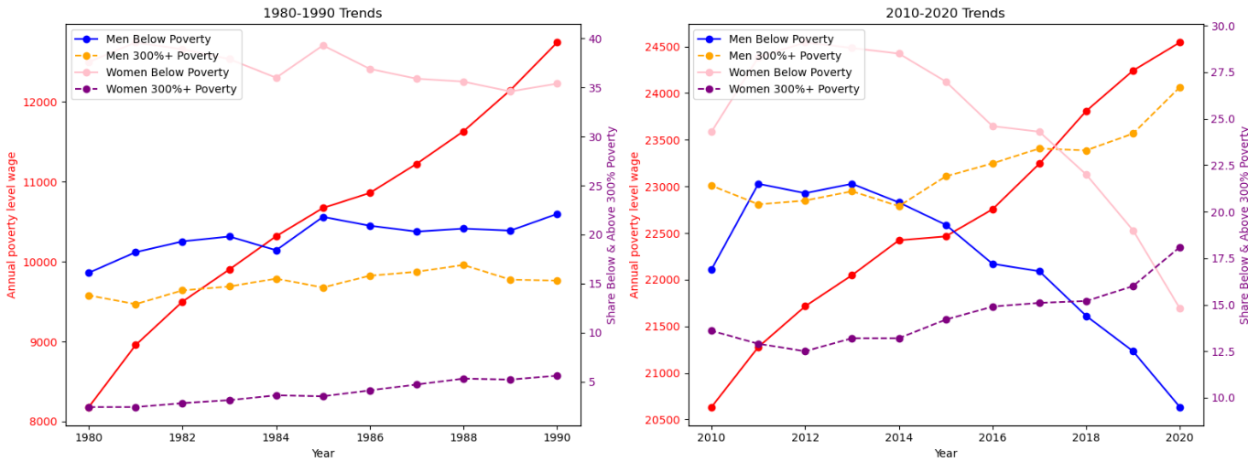
	Which could suggest: -income inequality where economic gains were concentrated among middle/higher earners, leaving low-income workers behind. -*decoupling* between labor productivity and wages, indicating weaker economic mobility.	other two's upward trend compared to earlier period, (where decoupling was significant). However, the gap between it and compensation remains wide, which could suggest deeper structural issues.

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, 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 indicates that low-wage workers were not fully sharing in the economic gains.	This suggests that income inequality widened. Poverty-level wages may have become more dependent on other factors like minimum wage hikes or targeted policies, rather than broader economic growth.

Additionally, I wanted to observe some trends between both genders in terms of these parameters, which is shown below in the line plot.



Some key insights:

- Number of low-income women and men dramatically decreased (2nd period – latter half)
- Higher-income women and men noticeably increased (2nd period)

Conclusion:

Based on the above analysis, during 1980-1990, productivity grew steadily, but compensation and poverty-level wages lagged, reflecting income inequality. In 2010-2020, there was faster, more aligned economic growth, with an increase in men and women high earners, suggesting improved economic mobility. However, the analysis only partially answers the question, as it does not *fully* consider factors like minimum wage changes or inflation, nor does it explore deeper gender-related issues like occupational segregation. Additionally, focusing on median compensation may miss industry-specific trends. While the findings highlight progress in addressing poverty, they also emphasize the need for more detailed and causal research.