

# **“Bridging the Gap: The Impact of Wages and Housing Markets on U.S. Financial Stability”**

*Bhumika Mallikarjun Horapet, Nema Puthanveetil*

## **Introduction**

We chose to focus on the changes in minimum wage, the housing market, and affordability measures through inflation rates and the consumer price index as part of our analysis to answer:

1. How has the distribution of minimum wage changed over time, especially in comparison with the median household income? Are both livable earnings?
2. How was the housing market affected by the 2008 and 2020 recessions, when compared to non-recession time (around 2014-2015)
3. Have model predictions about inflation rates accurately captured the realized inflation rate, particularly around recessions? Do changes in these predictions seem to be acknowledged by the federal government through wage requirements?
4. Does our overall analysis seem to tell us that there is a gap in the USA's wealth distribution today?

To do so, we used economic data from the Federal Reserve Bank of St. Louis. We were interested in this topic because of the constantly changing financial landscape in the US, which have been extremely affected by two major events in our lifetime: the 2008 recession and 2020 covid pandemic. These events have not only reshaped market dynamics but have also had large impacts on living standards, income inequality and economic stability across groups. This was our motivation for choosing this topic which plays a pivotal role in everyday lives of Americans. Specifically, we aim to explore the relationship between wage policies, housing affordability, and economic resilience during times where the financial conditions were rather tight. The topics relevance is highlighted by the ongoing debates and policy discussions regarding the adequacy of the federal minimum wage, affordable housing, and the effectiveness of economics standards against inflation and unemployment during recession periods. By, focusing on these topics we want to point out that potential adjustments in federal wages could enhance the economic stability and support sustainable growth and fairness.

We hope that our visualizations and interpretations offer new perspectives on how to interpret the US’s financial situation and make a case for why the federal minimum wage should be reevaluated.

## Description of the Data

The dataset was an amalgamation of individual data frames from the St. Louis Federal Reserve website, all of which are housed at <https://fred.stlouisfed.org/>. Since we wanted to analyze factors in the United States which were most affected by or indicative of periods of recession, we chose quantities relating to minimum wage, income, unemployment rates, inflation, consumer price index, and house sales as part of our report. For each of these variables, we downloaded the Excel sheet, removed the first 10 columns which included basic information about the data (but were not records themselves), and added it to our final Excel workbook. Each variable is published as its own Excel file, associated with a date for each record in the files. We used these dates as a quasi-id variable to join the Excel sheets for when we wanted to do cross comparisons or build visualizations that used more than two variables.

The data was very clean, organized, and easy to access since it is controlled by a government agency. When combining records for minimum wage, we were missing data from South Carolina, Tennessee, Louisiana, Mississippi, and Alabama, since these states do not officially report their wages. Certain states also began reporting only after the general 1968 marker. For this geographic data, the region column was manually added based on the US Census designated region a state was classified to be in (US Census Bureau, 2020). Some of the variables were published based on their recurring nature financially, i.e. were recorded daily or weekly, whereas others were only updated annually. Because of this, our entire compiled dataset may be considered sparse. However, most variables were analyzed on their own or only joined with one or two other tables, so we would say that our data is complete. i.e., we would not be able to get a more complete set of data from any other source simply because quantities like median household income and house sale price change on a quarterly or yearly basis.

Our final and only calculated field was to estimate what percentage of housing salaried and hourly wage workers would spend on a monthly mortgage payment towards buying a home. Ideally, around 30% percent of one's income should be spent on housing (FDIC). We estimated the average income of an individual every month with 20% towards down payment and we used the average mortgage rate from a particular year to calculate the mortgage payment for every month based on the given year's median house sale price to estimate the average American's spending on housing. To calculate the income of an hourly wage worker, we estimated their time of employment annually to be 40 hours a week, 50 weeks out of the year.

## Analysis of Data Quality

Our data dictionary is as follows (note that all variables were of numeric type in our case):

VARIABLES	DESCRIPTION	FREQUENCY	YEARS	MIN VALUE	MAX VALUE
Minimum Wage	Combined Data of Minimum Wage in every state	Annual	1968-2024	\$0.75, KY	\$17.00, DC
Federal Minimum Wage	Federal minimum wage	Annual	1968-2024	\$1.60	\$7.25
Cyclical Unemployment Rate	Natural Rate of Unemployment (Short-Term)	Quarterly	1949-2024	4.42%, 2024	6.24%, 1978
Unemployment Rate	Overall Unemployment Rate	Monthly	1949-2024	2.50%, 1953	9.30%, 2010
Consumer Price Index	Consumer Price Index for All Urban Consumers: All Items in U.S. City Average	Monthly	2003-2022	182.60, 2003	282.39, 2022
Median Household Income	Real Median Household Income in the United States	Annual	1984-2022	\$56,780, 1984	\$78,250, 2019
Median House Sale Price	Median Sales Price of Houses Sold for the United States	Quarterly	1963-2023	\$17,800, 1963	\$479,500, 2022
Monthly New House Supply	Ratio of Monthly Supply of New Houses in the United States	Monthly	1963-2024	3.3, 2020	12.2, 2009
Mortgage	30-Year Fixed Rate Mortgage Average in the United States	Monthly, Average Quarterly	1971-2024	2.68%, 2020	18.45%, 1981
Inflation Consumer Prices	Inflation, consumer prices for the United States	Annual	1960-2022	-0.356%, 2009	13.549%, 1980
10 Year Inflation Rate Monthly	10-Year Breakeven Inflation Rate	Monthly	2003-2024	0.25%, 2008	2.88%, 2022
Estimated Percentage of Income for Housing	Percentage of monthly income used towards the estimated average mortgage payment	Annual	1984-2022	13.05%, 1986	35.19%, 2022

## Main Analysis

To answer our questions, we created two dashboards in Tableau, one with a focus on minimum wage (Fig 1), and another on housing and livability conditions in the US (Fig 9).

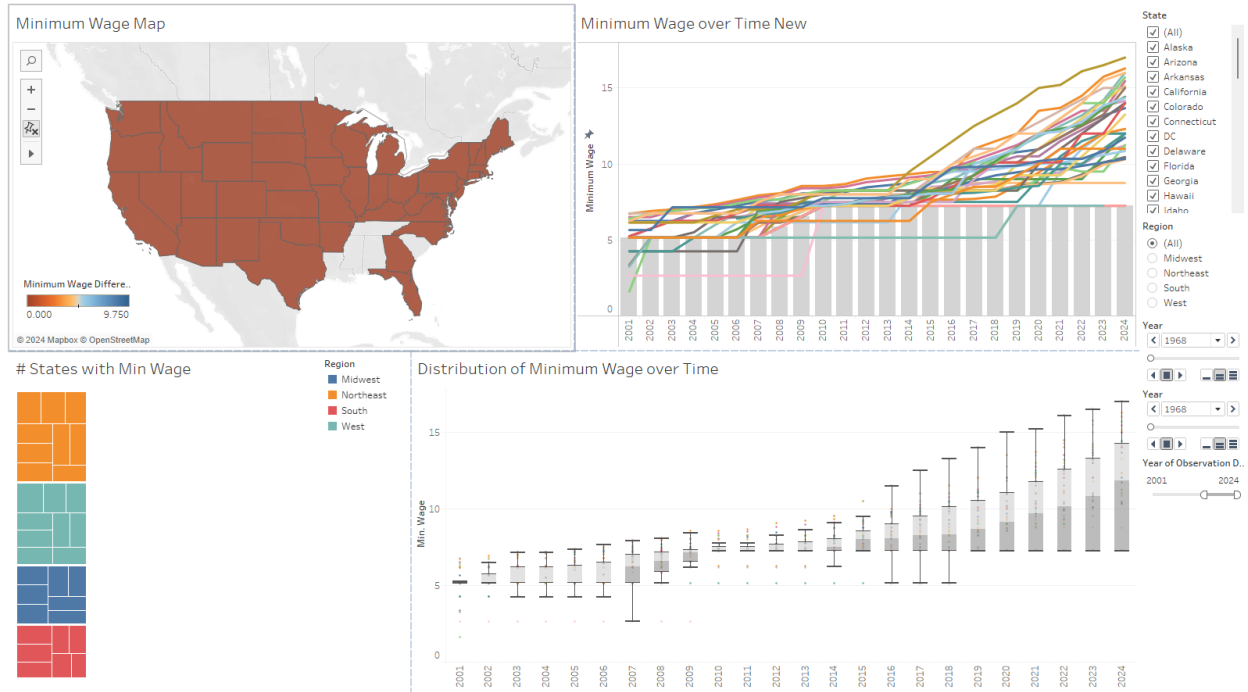


Fig 1: Dashboard-1

(For better context of our analysis, we recommend playing the animations that have been added to the first dashboard to fully understand how minimum wage has changed over time.)

In the map (Fig 2) tracking the change in the minimum wage for each state, we color the states based on how large the difference between the federal minimum wage and the given state's minimum wage is - red indicates little to no difference while blue signifies a more significant deviation from the federal requirement. We first noticed changes around 1990-1995, when Iowa and Oregon offer a wage that's 40 cents higher than the federal requirement. At the turn of the century, California, Washington, and a handful of states in the northeast region started to follow suit. Notice that in 2007, a larger number of states began to deviate from the federal minimum, only to be pulled back during the 2008 recession.

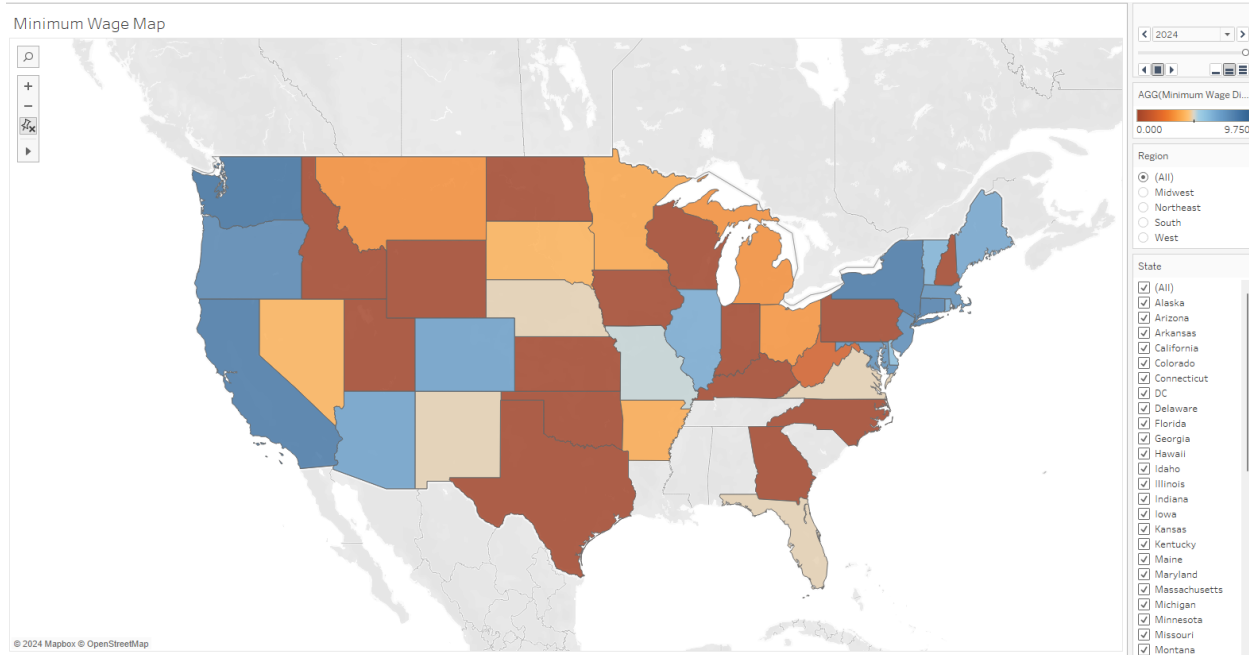


Fig 2: Cartogram - Minimum Wage Map

Unfortunately, the federal wage hasn't changed since the summer of 2009. In the past decade and a half, we see that a significant portion of states take hourly wages in their own hands. During the pandemic, states started passing legislation to increase their rates by incremental amounts every year until 2025, which is where we begin to see the biggest shift into blue colors on the map. This legislative action was referred to as the Raise the Wage Act, in which the House of Representatives has planned to reach a \$15 minimum wage by 2025 in stepwise (typically annual) increments; the current minimum is at \$7.25 an hour (Debt.org, 2021).

We then track the number of states with exactly the federal minimum wage over time. While this number has decreased in recent years, these states seem to be the largest catalyst for sustaining the gap between hourly and salaried workers and when comparing regions.

## # States with Min Wage 1968

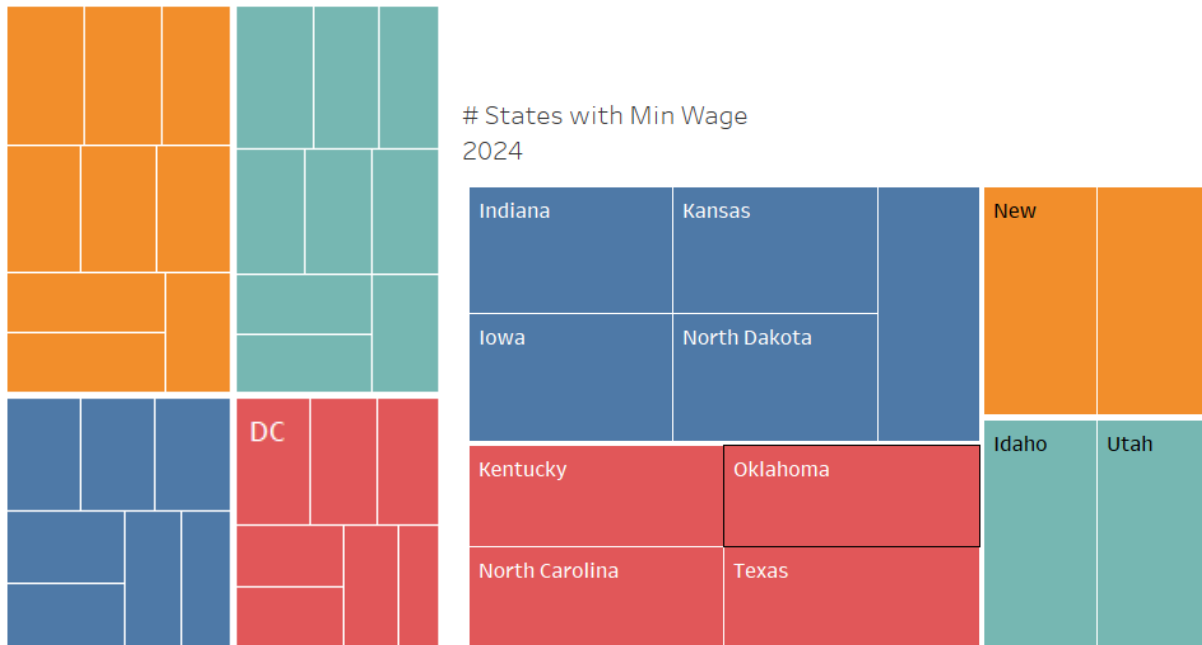


Fig 3: Tree map on States with Minimum Wage

As we move into more recent time periods, the West and Northeast regions tend to have fewer states sticking to the minimum wage (Fig 3). We think this could be influenced by the economic hotspots in states in California, New York, Massachusetts, and the DMV area. In fact, we can take a look at these states' changes in minimum wage when compared to those states who have stuck to the minimum in our line chart (Fig 4). The gray bars in the combined chart represent the federal minimum wage while the colored lines are for each state. Although states are required to pay at least the minimum wage for their hourly workers, tipped hourly workers must be paid only \$2.13 an hour (EPI, 2024). Additionally, if workers do not fall under Fair Labor Standards Act criteria, they may be paid the state's minimum wage, even if it is lower than the federal requirement (Debt.org, 2021).

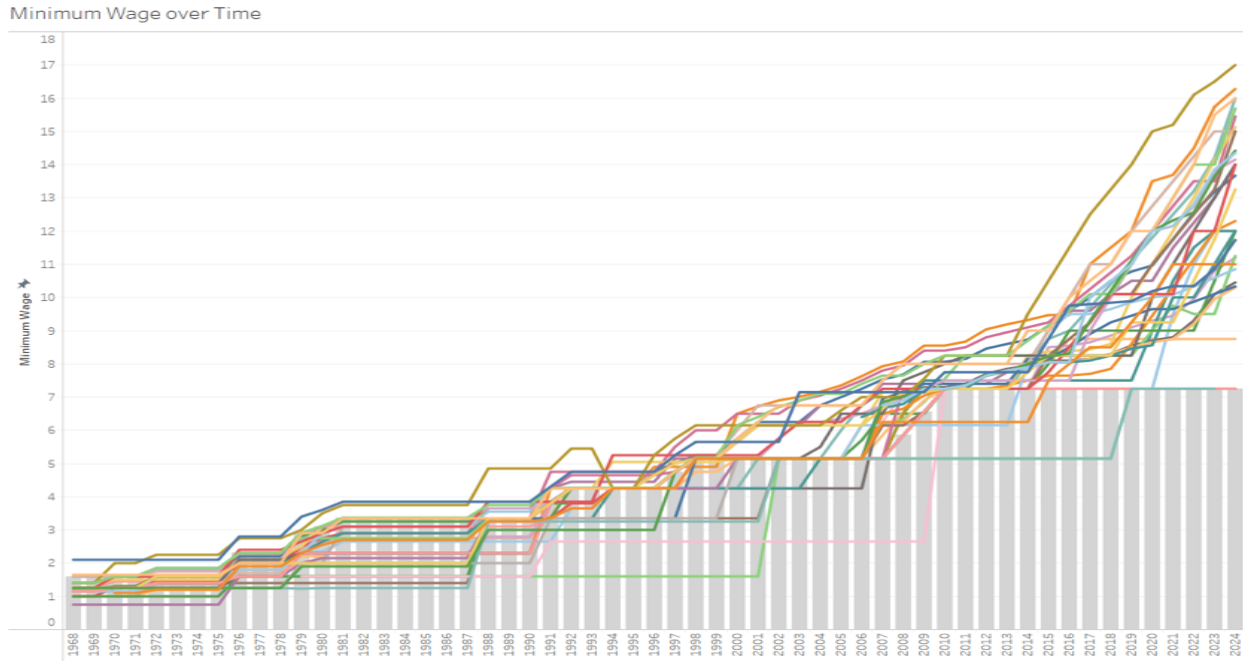


Fig 4: Minimum Wage over Time (All States)

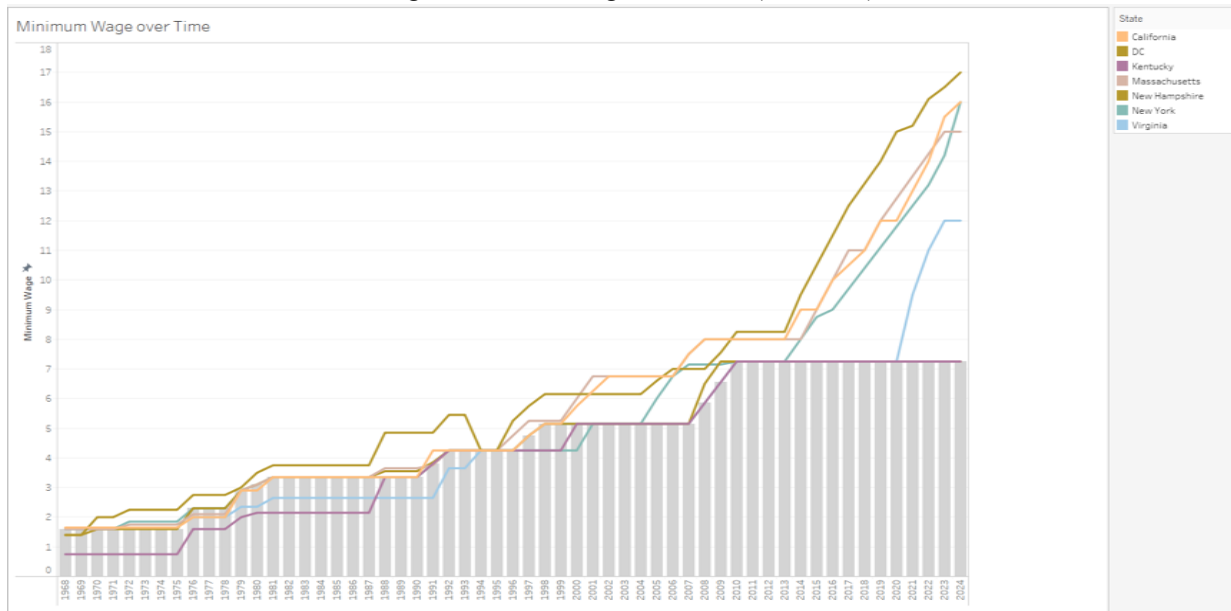


Fig 5: Minimum Wage in California, Dc, Kentucky, Massachusetts, New Hampshire, New York, and Virginia

In this second plot (Fig 5), we can see how states with major cities like California, New York, and DC itself have wages which are not restricted by the government's limit. The changes in these states have been more frequent. States like New Hampshire and Kentucky remain tied to the stagnant changes in the federal minimum wage. Virginia poses an interesting example of a state who switched from the minimum requirement to beginning to offer incremental changes based on the Raise the Wage Act's new standards (Virginia Law).

The last chart of boxplots (Fig 6) on the bottom right of the dashboard shows how the distribution of hourly wages seem to increase, beginning to hint at a gap in wealth distribution across the country. We notice that the distributions began rather tightly, with states and the federal minimum wage largely within the same neighborhood. As we move into more recent times, we see this distribution widening.

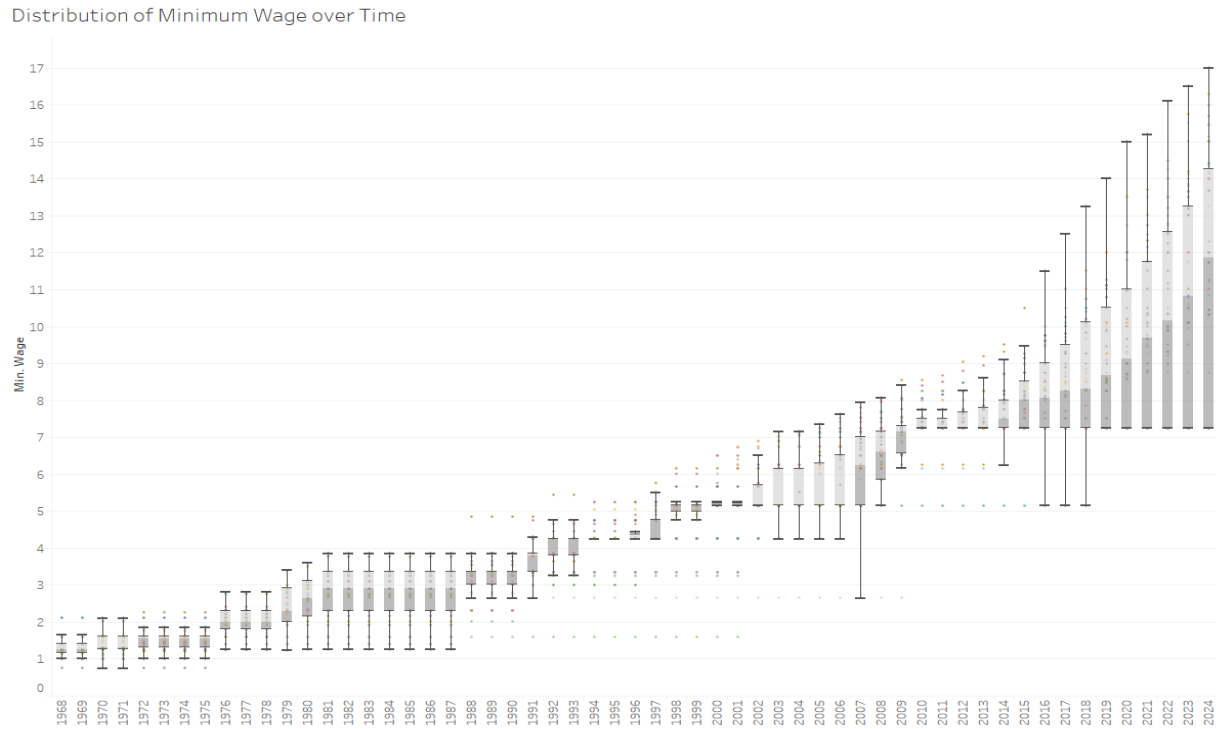


Fig 6: Boxplots on Distribution of Minimum Wage over Time



The largest gaps seem to be stemming from states in the South and West, as we can see below.  
(Fig 7 and 8)

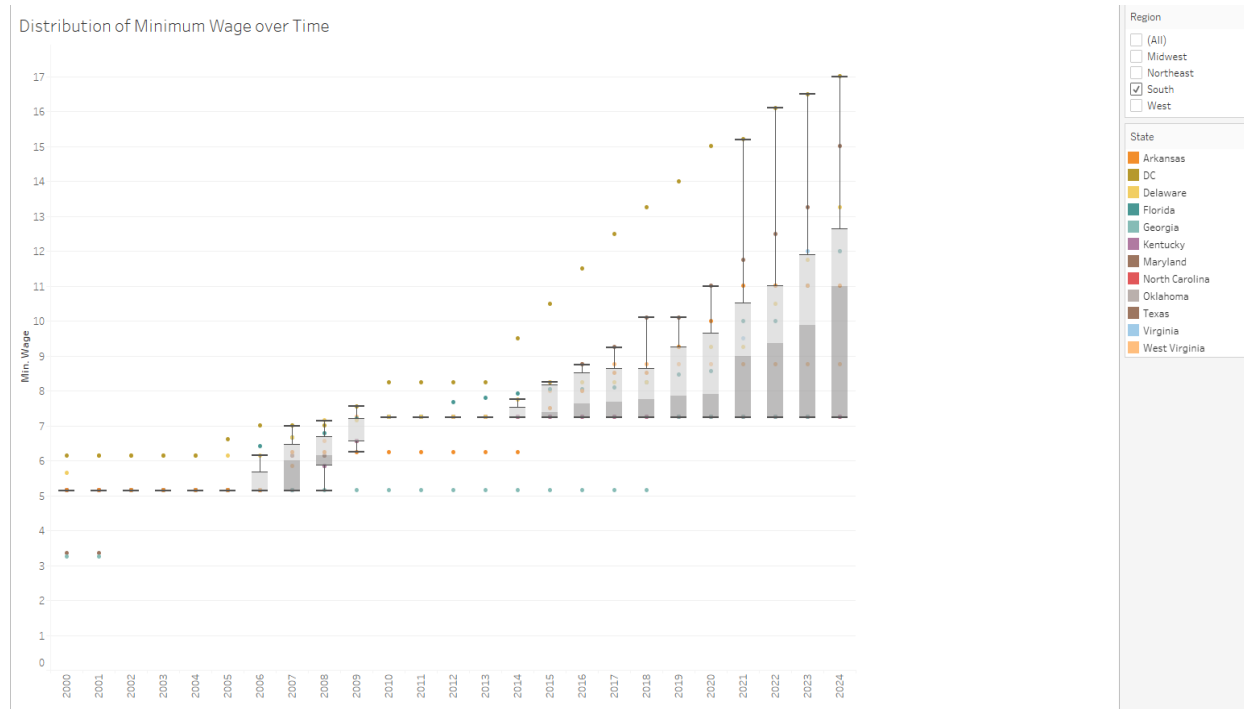


Fig 7: Distribution of Minimum Wage in the South Region

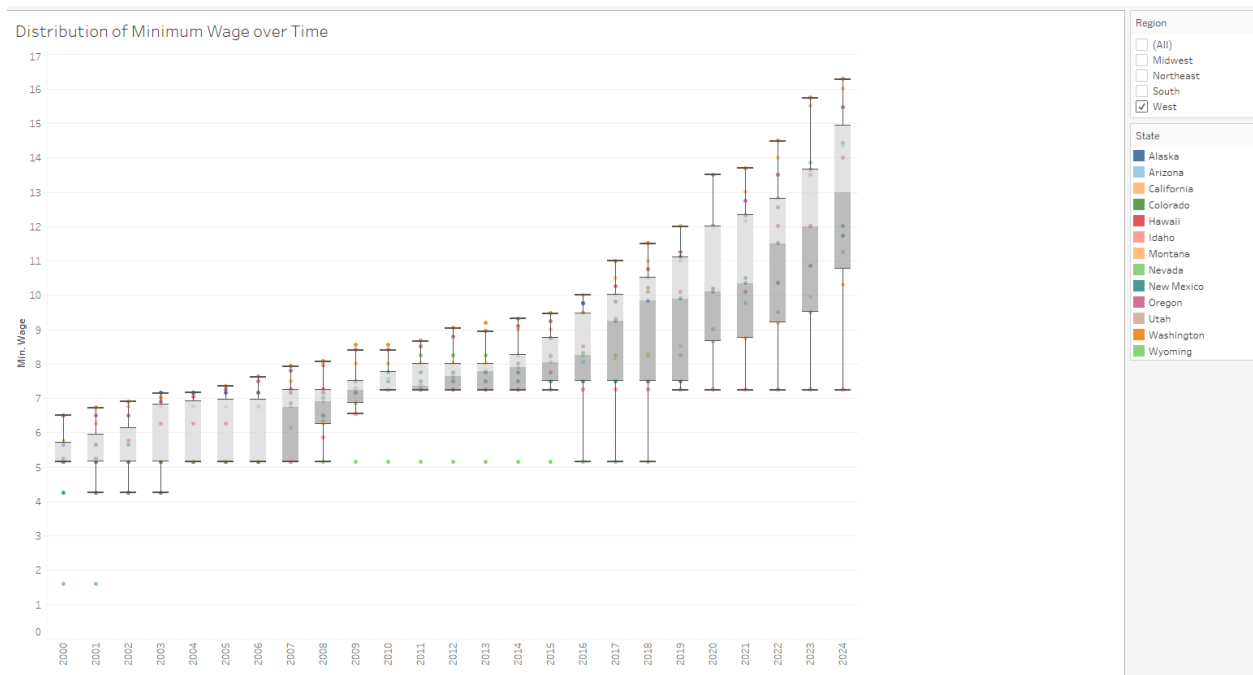


Fig 8: Distribution of Minimum Wage in the West Region

In our second dashboard (Fig 9), we make a stronger case for the discrepancy in wealth distribution and effects of recessions on financial well-being.

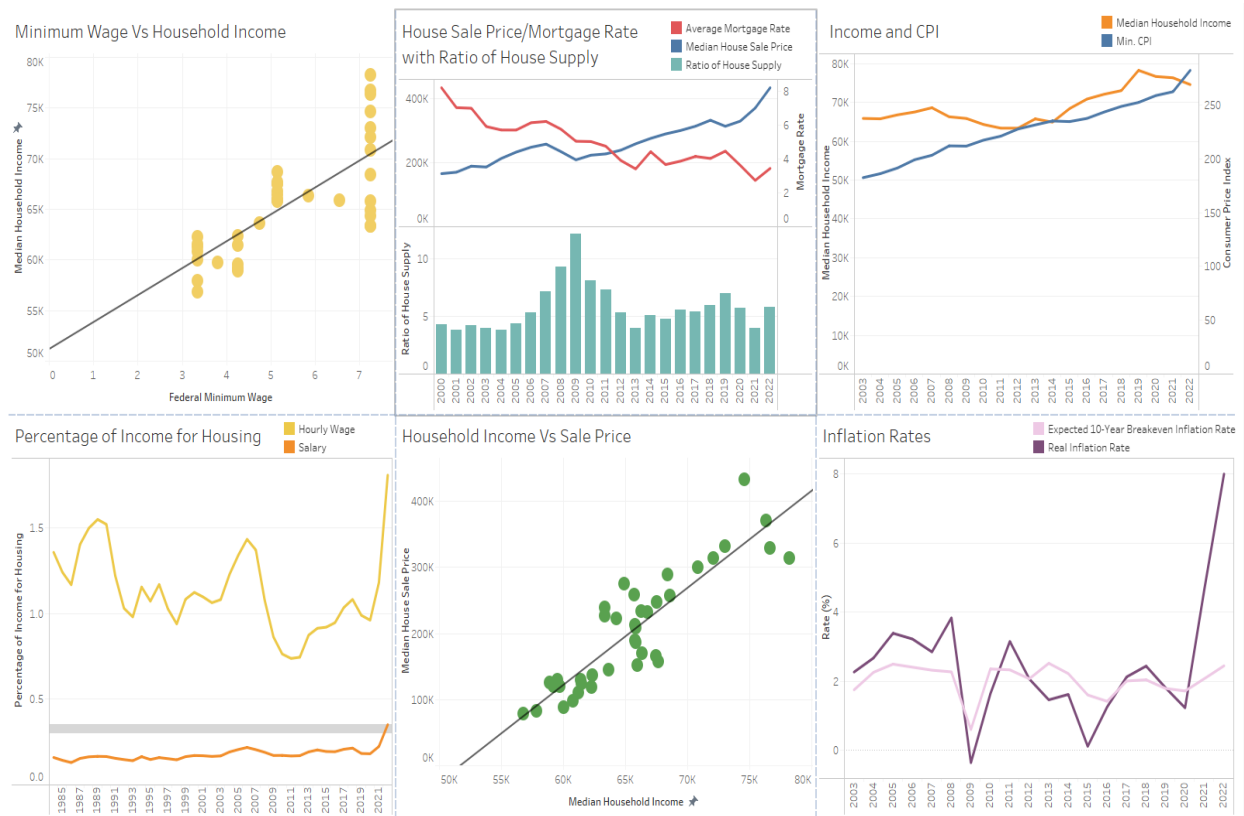


Fig 9: Dashboard-2

As we have mentioned before, the federal minimum wage has remained stagnant for over a decade, not accounting for inflation or increases in the cost of living. The median household income trend suggests adjustments that align more closely with living costs, whereas the minimum wage does not provide a livable income in many parts of the U.S., especially in urban areas where the cost of living is significantly higher.

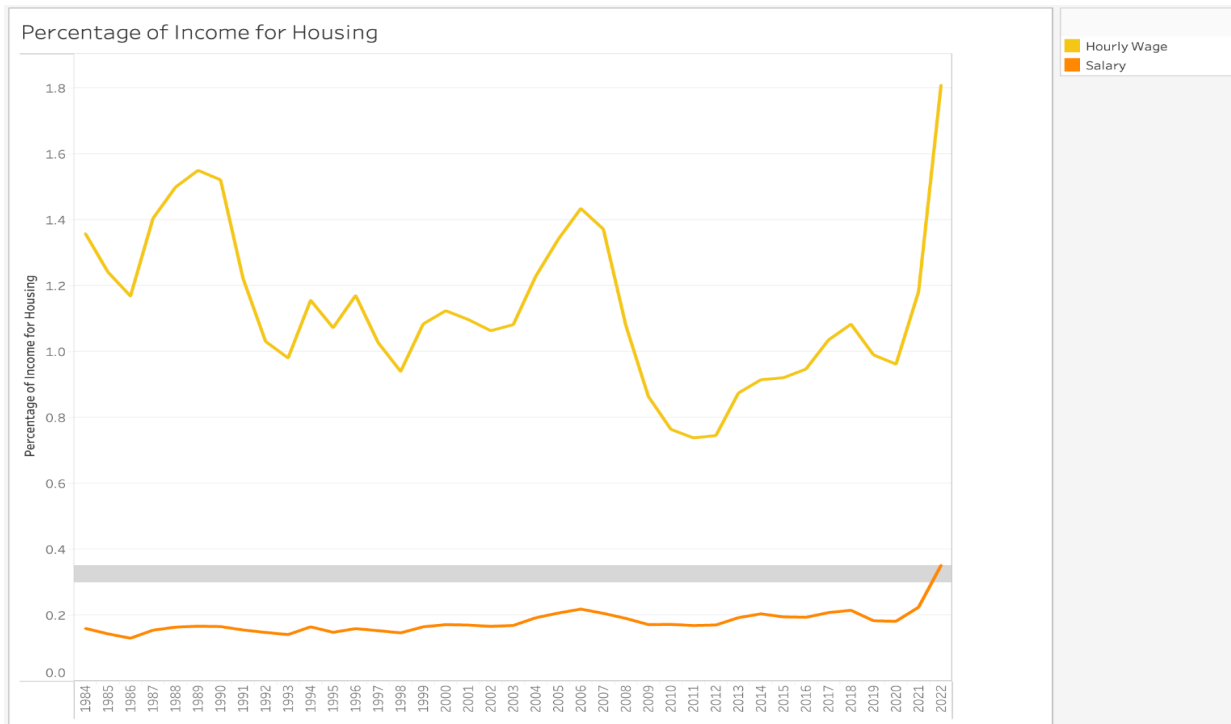


Fig 10: Percentage of Income for Housing between Hourly Waged and Salaried Individuals

The gray line in the above graph (Fig 10) represents the maximum recommended amount a person should spend on housing every month. A salaried person up until 2022 has been able to survive as compared to an individual earning an hourly wage, where we do not observe even a single year where a minimum wage worker comes close to being able to afford to live in an average house.

(We include just the estimated percentage of income used towards housing alone for clearer interpretation.)

Percentage of Income for Housing

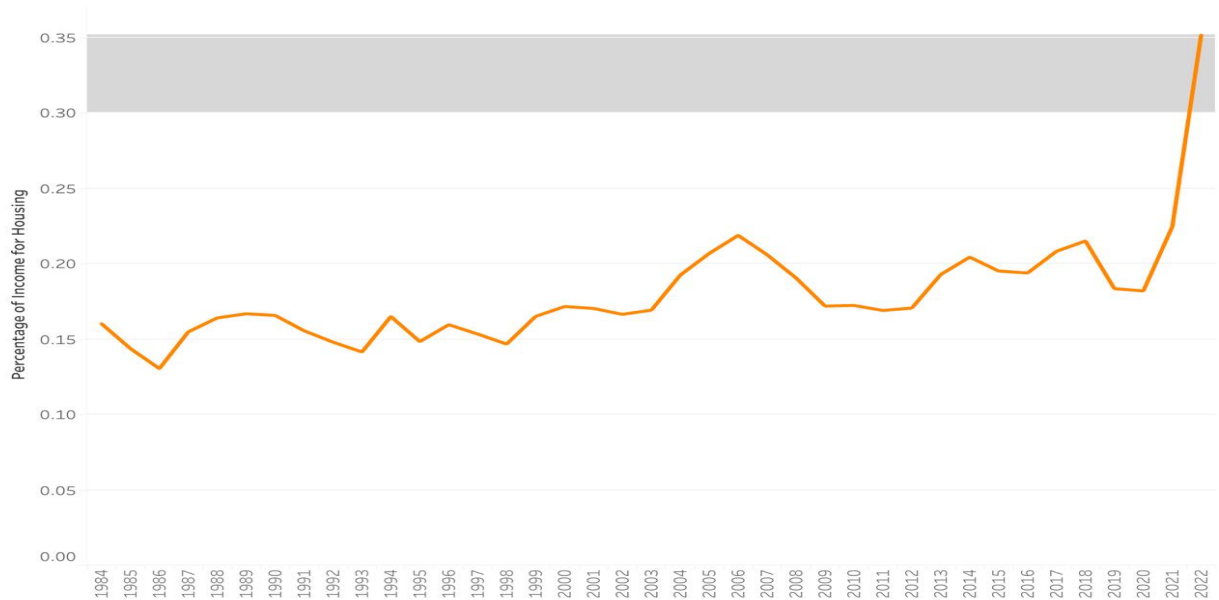


Fig 11: Percentage of Income towards Housing for Salaried Individual

What is interesting is the spike in average monthly housing costs even for workers paid on an annual basis in 2022 (Fig 11). This deviation in the otherwise trend of affordability for salaried employees highlights how significantly the covid pandemic affected the housing market.

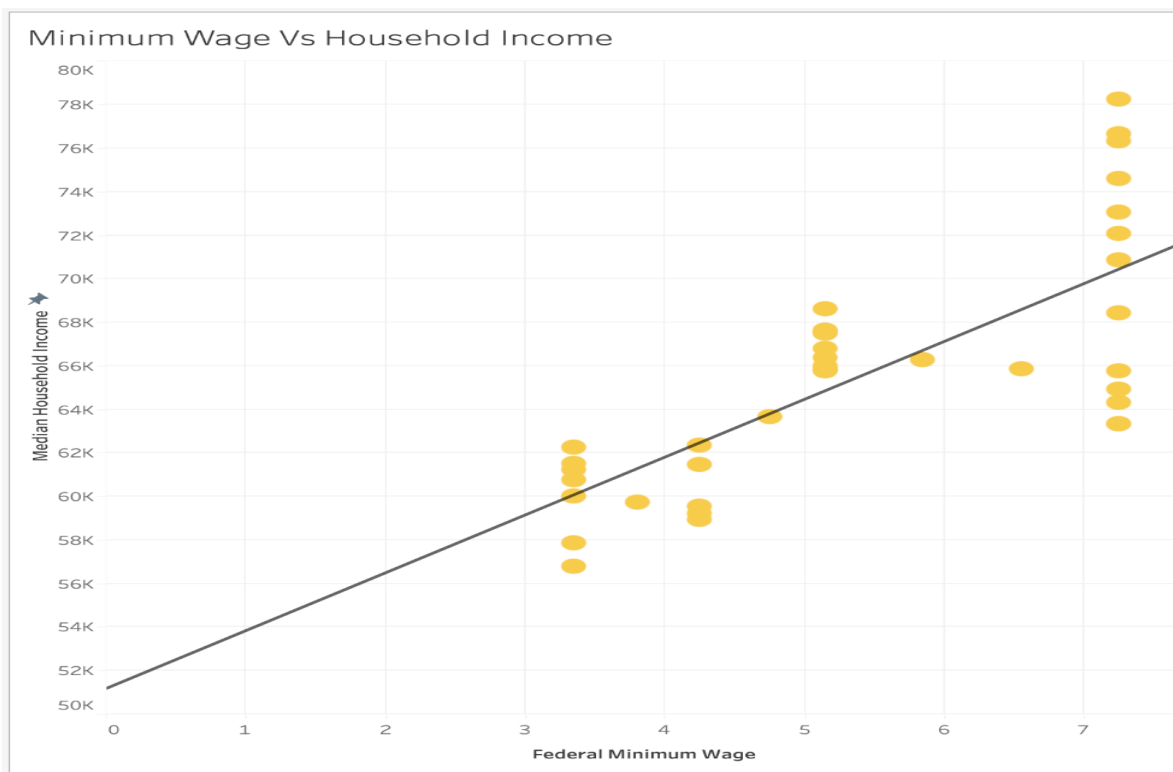


Fig 12: Scatter plot on Minimum Wage vs Household Income

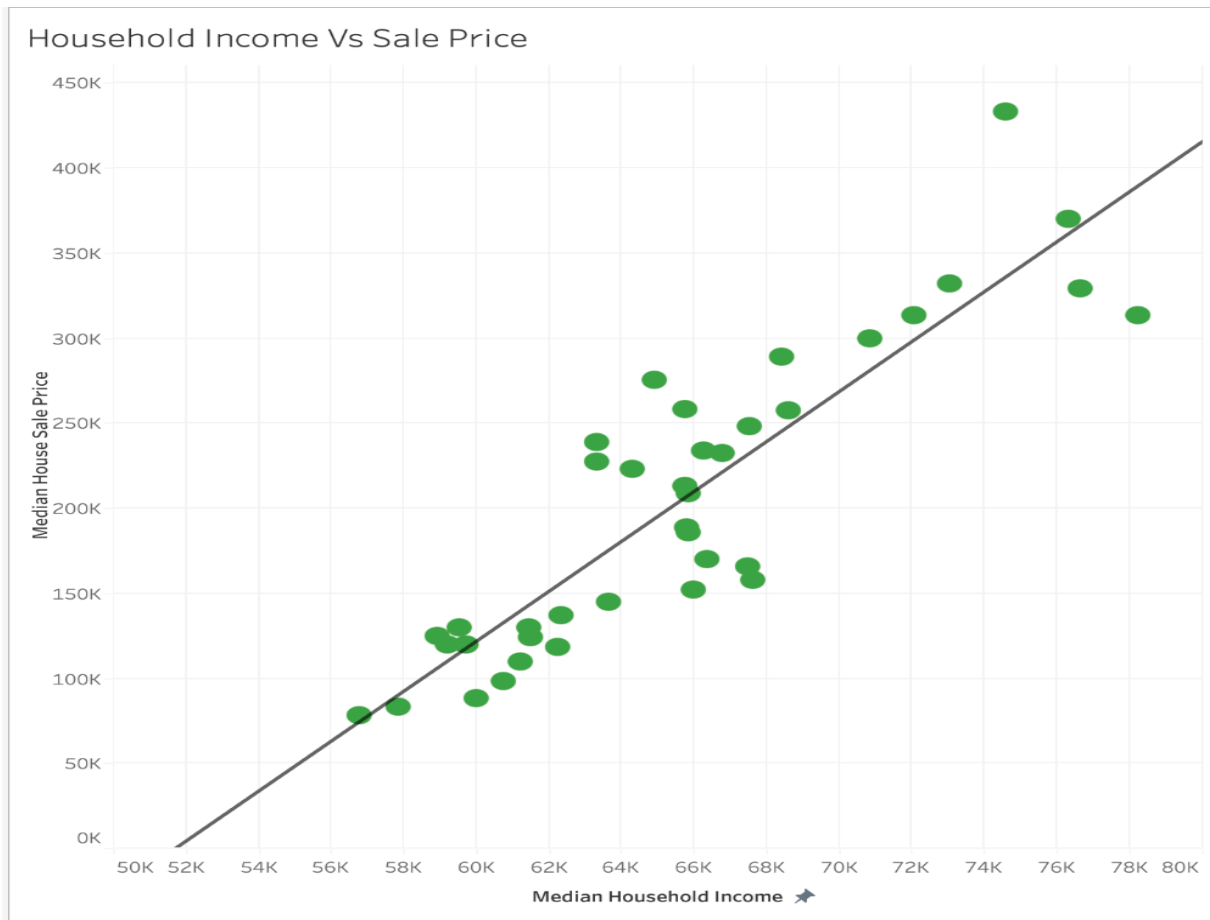


Fig 13: Scatter plot on Household Income vs House Sale Price

These scatter plots (Fig 12 and 13) further show that there is a wide gap between the wealth distribution as the median household income changes more frequently than does the minimum wage. We can see this through the almost piecewise-like function occurring in the left-hand plot.

Even though this scatterplot (Fig 12) has a positive correlation, our r-squared value of 59% is not strong enough; to combat the growing wealth gap, we would ideally want hourly and salaried workers to experience increases in income more linearly and synchronously. The median household income follows a more linear trend (Fig 13) with an r-squared value close to 80%, signifying how important allowing for changes in the living, namely housing, costs is.

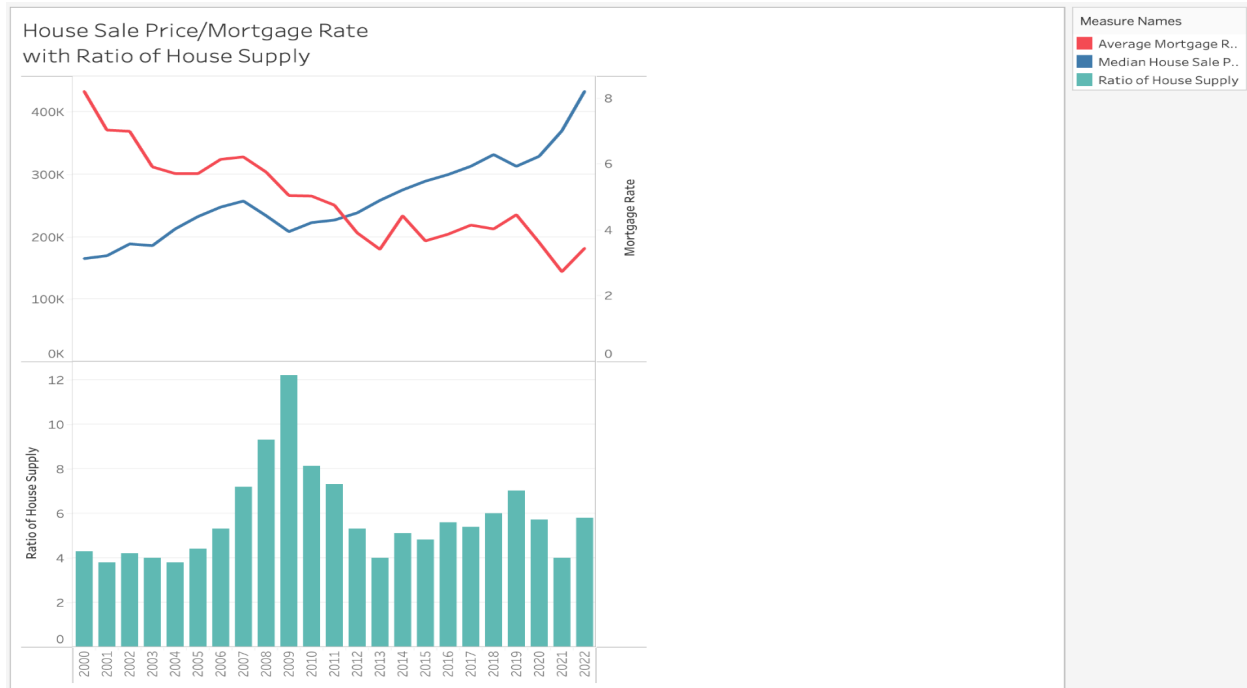


Fig 14: Graph comparing the House Sale Price and the Mortgage rate with the Ratio of House Supply

The 2008 financial crisis caused a significant drop in house prices and a surge in housing supply due to foreclosures and short sales by banks (First Tuesday Journal). We can see the housing bubble of 2008 visualized by the low house prices, coupled with low mortgage rates in the line charts and incredible supply for increasing demand as seen in the bar chart below (Fig 14). To further contextualize the financial situation, we include a brief analysis on the unemployment rates during recessions.

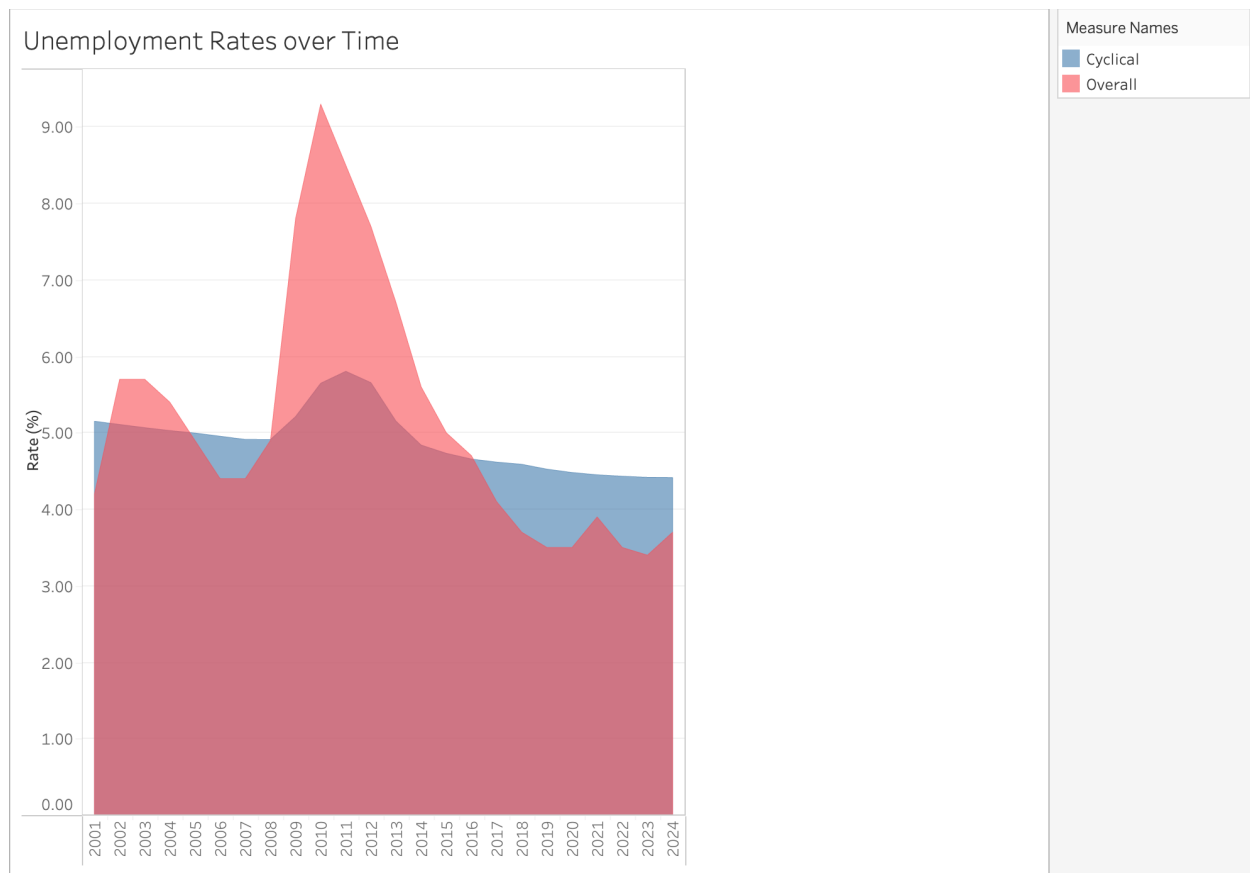


Fig 15: Area chart representing Cyclical and Overall Unemployment Rate over Time

Due to the high unemployment rate around the 2008 recession (Fig 15), individuals were not able to keep up with their mortgage payments. In response, banks repossessed houses on a large scale. With a crippled labor force who could no longer pay for even regularly priced housing costs, let alone meet the highly inflated sale costs that were characteristic of the 2000 housing market, houses were sold either as shorts sales or foreclosures (below the previously sold price), leading to the drastic economic downturn (First Tuesday Journal).

In contrast, shortly after 2020, the pandemic induced recession created a desire among US residents for permanent housing as remote jobs became more predominant. With a record low mortgage rate and demand rapidly increasing, housing supply has not been able to keep up with newly hopeful homebuyers, driving prices beyond affordable rates as we've discussed in earlier visualizations. An unprecedented refusal from the baby boomer generation to move from homes further added to the bottleneck circumstances of houses available to sell (Fleming 2022).

In short, factors driving demand are met with limited supply, leading to record setting house sale prices and a rather different housing bubble related to the 2020 pandemic recession.

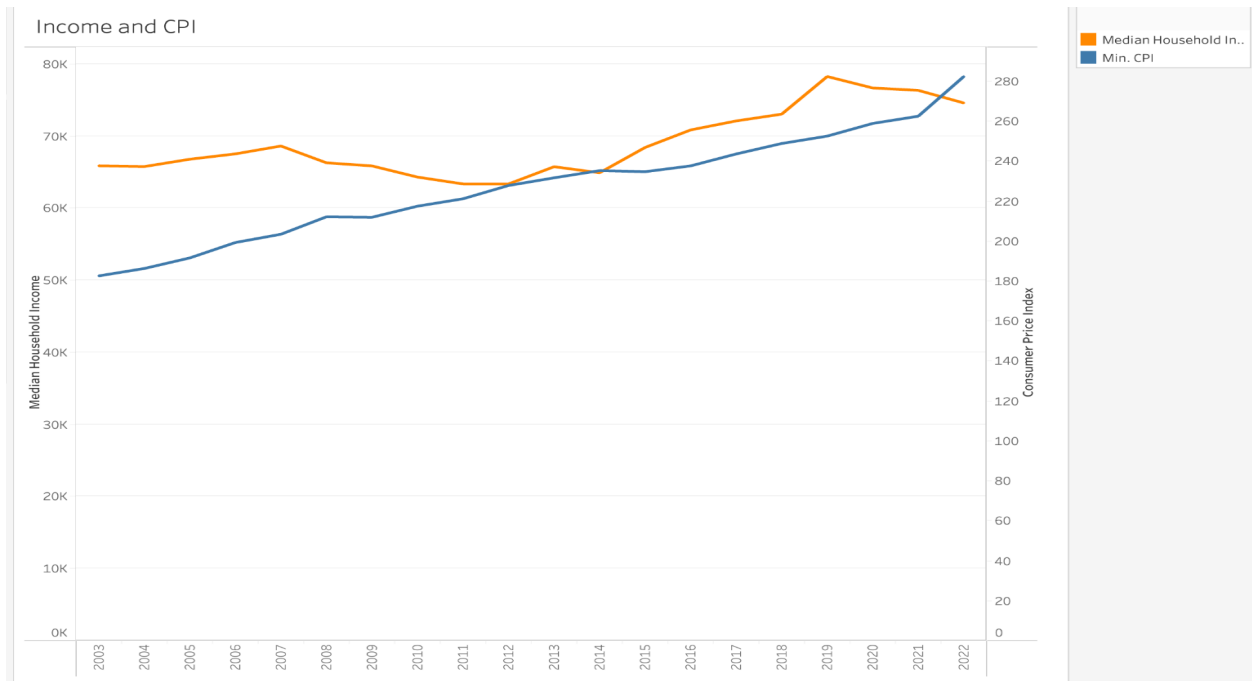


Fig 16: A line graph showing difference in Income and Consumer Price Index

The Consumer Price Index line (Fig 16) shows a general uptrend, which is expected as inflation typically causes prices to rise over time. In line with other uncharacteristic changes in the economy around the pandemic, the CPI growth currently has outpaced the income growth, further indicating that there should be some sort of policy intervention aimed towards both hourly wages and income.





Fig 17: Real Inflation vs 10 Year Breakeven Inflation

Finally, when analyzing the inflation rates over the 10-year breakeven rates, i.e. the estimated values (Fig 17), we observe that the trends are not always parallel, which may be because of the influence of realized short-term factors versus the long-term expectations calculated by FRED's models. But the widening gap in wealth distribution caused by consistent federal minimum wage limits seems to indicate that the government has especially underestimated the cost of living in recent years. The huge spike seen around the pandemic is not mitigated by the hourly pay floor. This analysis lends us to believe that it is high time our financial situation was addressed and reevaluated. The models which are used for such predictions may need different weights added to their variables based on whether a recession has occurred within the past 3 years. Moreover, the severe disparagement in the two values around 2020 suggest that a different approach needs to be taken when evaluating economic downturns caused by a pandemic.

## Key Findings

Our analysis confirms a significant gap in wealth distribution in the U.S., especially apparent during the 2008 recession and further widening during the COVID-19 pandemic. Though some states have passed legislation pledging to increase the rates to \$15, other states remain tied to the minimum requirement which has stayed constant over the past 15 years. Analyzing inflation rates, housing costs, and the consumer price index have made it evident that the current minimum wage does not allow an hourly worker to even come close to living like an average American. Particularly around periods of recession, we see that even salaried workers become financially unstable, and the labor force experiences high rates of unemployment. Changes surrounding the housing market are more nuanced as we've seen by comparing the 2008 recession and 2020 pandemic. Predictive models of inflation have consistently underestimated actual inflation rates during recessions, which suggests a need for more dynamic economic modeling. The stagnation of the federal minimum wage, coupled with rising living costs, has exacerbated economic inequality, erasing the hope of middle-class stability for hourly wage workers, and even shaking the soundness of the middle-class salary.

## Conclusion

Because all our data was time-oriented, it was rather difficult to do more complex analysis on the financial situation of the US, particularly through a data visualization lens. Time-series analysis and forecasting may be better suited for some of the quantities we included in our paper. Certainly, a major limitation would be our calculations for the estimated percentage of income used towards housing. We acknowledge that requirements that must be satisfied before approval for a mortgage loan are not one-fold and our methods for getting an estimated quantity may be too general or even fundamentally flawed. That being said, we emphasize 'estimates' here, reminding ourselves and the reader that these values in particular are not meant to be taken for face-value. We also recognize that certain portions of our combined dataset may not qualify to be considered 'big data'. However, we made use of all data that was available to us and were limited to the constraints of how often financial data is updated.

For future work, we'd be very interested in developing our own models to make a stronger case for how affordability and wages have changed over time. Expanding our analysis to include Reagan's Recession in the early 1980s (along with the 1930s Great Depression) would likely strengthen the arguments we make about raising wages to be reflective of a changing economy. Perhaps we could provide more insight on why recessions are almost cyclical, operating on a 10-year basis, which in turn could mitigate the effects of, inevitably, our next recession. Combining US data with international data may also allow for further contextualization (and even bring our dataset into the realm of big data). Until then, we hope that our current analysis mobilizes legislators and financial authorities to consider new approaches to help close the gap between socioeconomic classes in the US and offer the opportunity of a financially stable life to a larger number of Americans.

## References

- Census Regions and Divisions of the United States*, US Census Bureau, [www2.census.gov/geo/pdfs/maps-data/maps/reference/us\\_regdiv.pdf](http://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf).
- “Code of Virginia: Title 40.1. Labor and Employment.” § 40.1-28.10. *Minimum Wages*, Virginia Law, [law.lis.virginia.gov/vacode/title40.1/chapter3/section40.1-28.10/](http://law.lis.virginia.gov/vacode/title40.1/chapter3/section40.1-28.10/).
- Fay, Bill. “How Minimum Wage Works: Federal & State.” *Debt.Org*, Debt Help Organization, 27 Apr. 2021, [www.debt.org/jobs/minimum-wage/](http://www.debt.org/jobs/minimum-wage/).
- Federal Reserve Bank of St. Louis. Federal Reserve Economic Data, 2024, <https://fred.stlouisfed.org/>.
- Fleming, Mark. *Are Baby Boomers the Key to the Housing Market Shortage?*, First American Exchange Company, 2022, [www.firstexchange.com/arebabyboomersthekeytothehousingmarketshortage](http://www.firstexchange.com/arebabyboomersthekeytothehousingmarketshortage).
- Great Recession and Its Aftermath*, Federal Reserve History, Federal Reserve, <https://www.federalreservehistory.org/essays/great-recession-and-its-aftermath>.
- “How Much Mortgage Can I Afford?” *FDIC*, Federal Deposit Insurance Corporation, [www.fdic.gov/consumers/consumer/moneysmart/podcast/documents/borrowing-money-how-much-mortgage-can-i-afford.pdf](http://www.fdic.gov/consumers/consumer/moneysmart/podcast/documents/borrowing-money-how-much-mortgage-can-i-afford.pdf).
- “Minimum Wage Tracker.” *Economic Policy Institute*, 1 Mar. 2024, [www.epi.org/minimum-wage-tracker/#/min\\_wage/Washington%20D.C](http://www.epi.org/minimum-wage-tracker/#/min_wage/Washington%20D.C).
- Short Sales Explained*, First Tuesday Journal, <https://journal.firsttuesday.us/real-estate-knowledge-explained/short-sales-explained/>