Examining the Impact of Demographic Factors on Housing Prices:

A Tableau Analysis of Zillow Data

1. INTRODUCTION:

Background:

- Housing prices in the United States have surged over the past few years, outpacing inflation, and wage growth.
- Researchers have hypothesized that demographic and socioeconomic factors at the county level may be key drivers behind the rapid home price appreciation.
- For example, prior studies have suggested population growth, higher incomes, and increasing educational attainment in an area correlate with rising housing demand and prices.
- However, much of the previous research has relied on data from before the recent housing boom or examined just one or two factors in isolation.
- Leveraging newly released, comprehensive datasets on Zillow home values, population, income, and education attainment across US counties from 2020 to 2022, this report reexamines these relationships in depth to provide updated understanding of the factors associated with the run-up in home prices.

References:

1) *Gallin, J.*

   Gallin, J. (2006). Real Estate Economics, 34(3), 417–438. doi:10.1111/j.1540-6229.2006. 00172.x

2) *Leung, C.*

   Leung, C. K. (2003). Pacific Economic Review, 8(2), 183–190. doi:10.1111/j.1468-0106.2003. 00219.x

Research Questions:

I aim to investigate the following questions:

1) Is there any relationship between the increase in the population and the change in house prices?
2) Is there a relationship between changes in neighborhood income levels and home value appreciation over time?

The goal of addressing these two research questions would be:

- To understand the relationship between population changes and home values, specifically whether population growth or decline in a state corresponds to increasing or decreasing housing prices. This can provide insight into how shifts in housing demand influence pricing.
- To evaluate the connections between socioeconomic factors - income and educational attainment - and home values at the state level. The aim is to reveal whether higher socioeconomic status, as measured by these metrics, is associated with more expensive housing prices.

Overall, answering these research questions aims to quantify the impact of demographic and socioeconomic factors on the Zillow housing market from 2020-2022. The goal is to use data analysis to determine the degree to which changes in population, income, and education correlate with and potentially drive trends in home values

across U.S. states. This can enhance our understanding of the key demand-side drivers contributing to housing price changes.

2. METHODOLOGY:

For the analysis of the project, I am using four datasets.

1) Zillow Housing dataset:

- I have obtained the Zillow housing dataset from **Housing Data – Zillow Research.** This is a time series dataset tracking monthly housing prices for counties across the US from January 2000 to September 2023. The key data columns are the monthly housing price values for each county.
- For data cleaning and preprocessing, I used Tableau Prep Builder to select only the relevant columns for analyzing the dataset. I filtered the data to include housing prices from January 2020 to September 2023.
- Link to the dataset: https://www.zillow.com/research/data/

2) Population dataset:

- I have taken population dataset from **United States Census Bureau.**
- This is a county-level population dataset for counties across the United States, enabling analysis of population changes and demographics from 2020 to 2022. The dataset provides granular population data at the county level, including population estimates, births, deaths, migration, and other demographic details.
- For data cleaning and preprocessing, I used Tableau Prep Builder to select only the relevant columns for analyzing the dataset.
- Link to the dataset: https://www.census.gov/data/datasets/time-series/demo/popest/2020s-counties-total.html

3) Income dataset:

- I have taken Income dataset from **Bureau of Economic Analysis.**
- This is a dataset showing per capita income data by county for all 50 states in the US for 2020 and 2021. The comprehensive, nationwide county-level data allows for in-depth income comparisons and analysis of income changes across the two-year period at the county level for the entire country.
- For data cleaning and preprocessing, I used Excel to convert the format of the original data into an Excel workbook format. This allowed me to easily load the cleaned dataset into Tableau for further analysis and visualization.
- Link to the dataset: https://www.bea.gov/data/income-saving/personal-income-county-metro-and-other-areas

4) Educational Attainment dataset:

- I have taken Educational Attainment dataset from **United States Census Bureau.**
- The data is at the county level for all 50 states in the US. It provides a detailed breakdown of educational attainment for the population across different age groups and races.
- For data cleaning and preprocessing, I used Tableau Prep Builder to select only the relevant columns for analyzing the dataset.
- Link to the dataset: https://data.census.gov/table/ACSST1Y2022.S1501?q=Educational+Attainment&g=010XX00US$0500000

3. ANALYSIS:

- I have loaded four datasets into Tableau - Housing, Population, Income, and Economic data. Before loading, I added a "Postal Abbreviation" column to each by abbreviating the State names. This allowed me to link the datasets together in Tableau using the Postal Abbreviation field. By combining the datasets, I can now analyze how demographics like population, income, and economic factors impact Zillow housing prices. After linking the data in Tableau, I prepared it for creating visualizations. These will show the relationships between housing prices and demographic factors.
- I have created three separate calculated fields, one for each year's average Zillow house price in 2020, 2021,2022 and 2023.
- With the help of these calculated fields, I was able to analyze the patterns of the housing prices yearly rather than monthly.

1) How do birth rates and death rates for each U.S. state in 2022 compare?

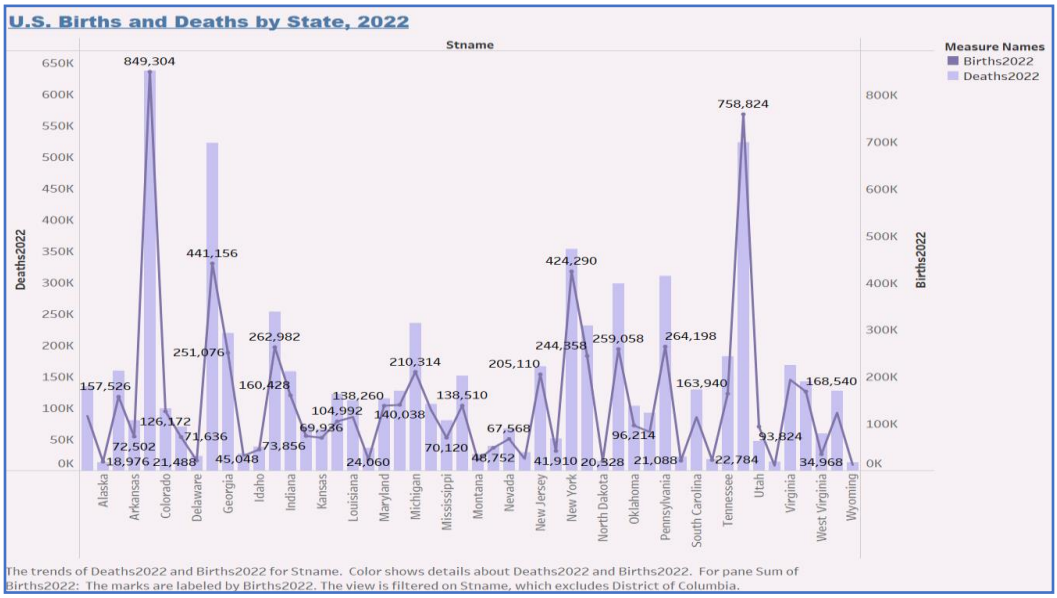


Figure 1 : U.S. Births and Deaths by State, 2022

- The dual axis chart (Figure 1) illustrates the number of births and deaths in each U.S. state in 2022. The line chart shows the total births per state, while the bar chart displays the total deaths.
- California had the highest number of births at 849,304, followed by Texas with 758,824 births. In contrast, Vermont had the fewest births at just 10,684, followed by Wyoming with 12,378.
- For total deaths in 2022, California also ranked highest with 636,994 deaths, trailed again by Texas with 522,506 deaths. Alaska and Wyoming had the fewest deaths, with only 12,792 and 13,378 respectively.
- There appears to be a moderate positive correlation between births and deaths by state. States with more births tend to have more deaths as well, which is likely related to their larger populations.

2) Is there a correlation between average house value and population estimate across U.S. states in 2021?

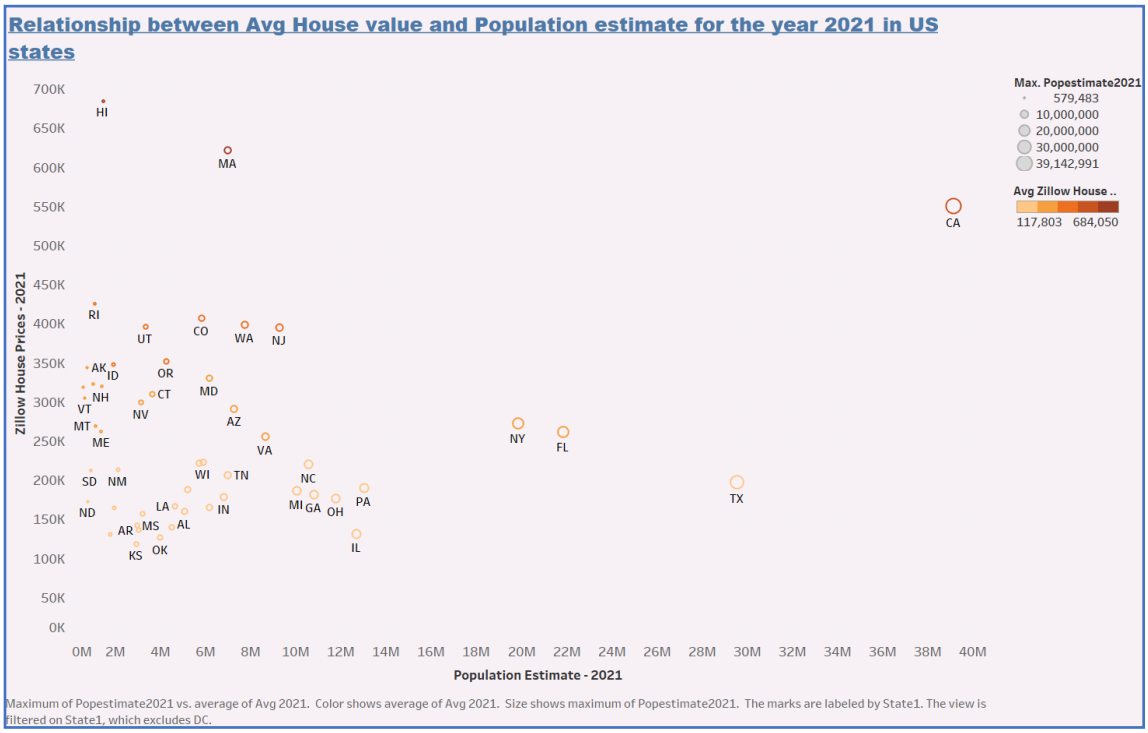


Figure 2 : Relationship between Average Zillow House Value and Population in 2021

- The scatter plot in Figure 2 shows the relationship between average Zillow home value and population across U.S. states in 2021.
  A few key observations:
- California had the highest population at 39.1 million, but its average Zillow home value of $550,299 was not the highest.
- Hawaii had the highest average Zillow home value at $684,050 despite having just 1.4 million residents. Massachusetts had the second highest home value of $620,811 with 6.9 million residents.
- On the other end, Kansas had the lowest average Zillow home value of $117,803 with 2.9 million residents. Oklahoma had the second lowest value at $125,770 with 3.9 million residents.
- In general, higher population states like California and Texas did not necessarily have the highest home values. Less populated states like Hawaii and Massachusetts topped the home value list.
- There is not a clear linear correlation between higher population and higher home prices. Some low population states like Hawaii and Massachusetts have very high home prices, while the high population states of California and Texas do not top the list.

3) What is the correlation between Per Capita Income and average Zillow home value for U.S. states in 2021?

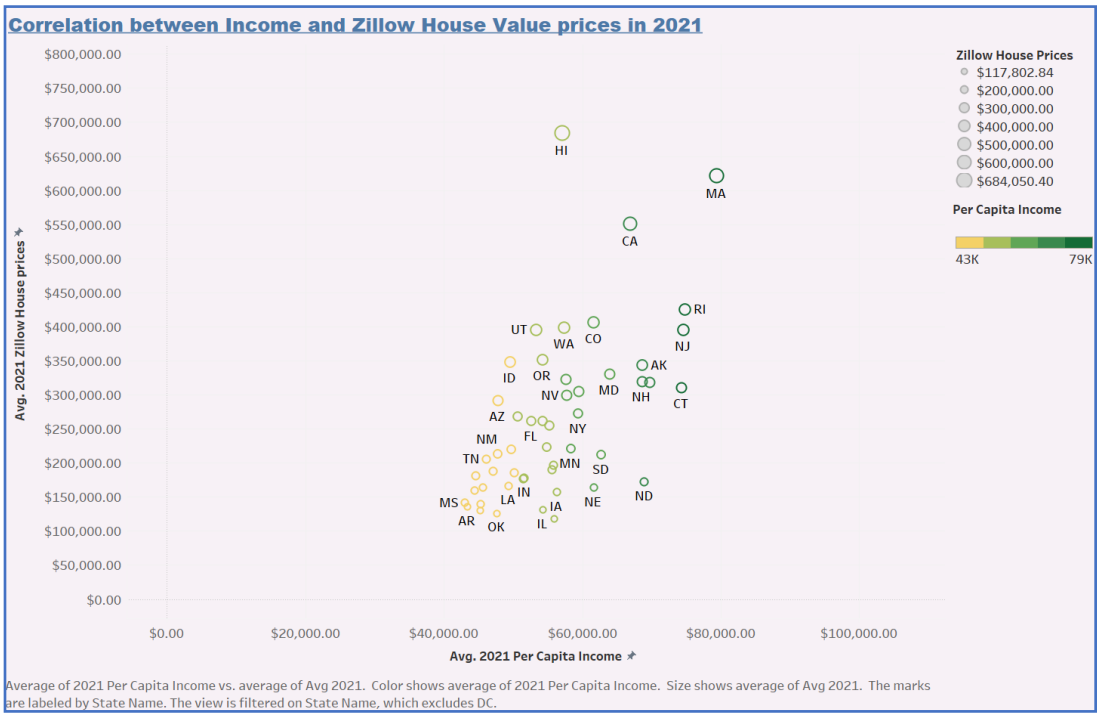


Figure 3: Correlation between Income and Zillow House Value prices in 2021

- The scatter plot in Figure 3 shows the relationship between average Zillow home values and per capita income across U.S. states in 2021.
- Hawaii had the highest average Zillow home value ($684,050) but not the highest per capita income ($57,143). Massachusetts had the second highest home value ($620,810) and the highest per capita income ($79,424).
- Kansas had the lowest average home value ($117,802) but not the lowest per capita income ($55,945).
- Mississippi had the lowest per capita income ($43,064) but not the lowest average home value ($141,090).
- There are several U.S. states with per capita incomes ranging from $43,064 to around $50,000. The home values in these states tend to be in the range of $125,000-$347,000.
- Per capita income and average home values have a positive correlation, but the relationship appears moderately correlated rather than perfectly correlated, based on this analysis.

4) What is the correlation between the percentage of adults with a bachelor's degree or higher and average Zillow home values across U.S. counties in 2021 based on data from the U.S. Census Bureau and Zillow?

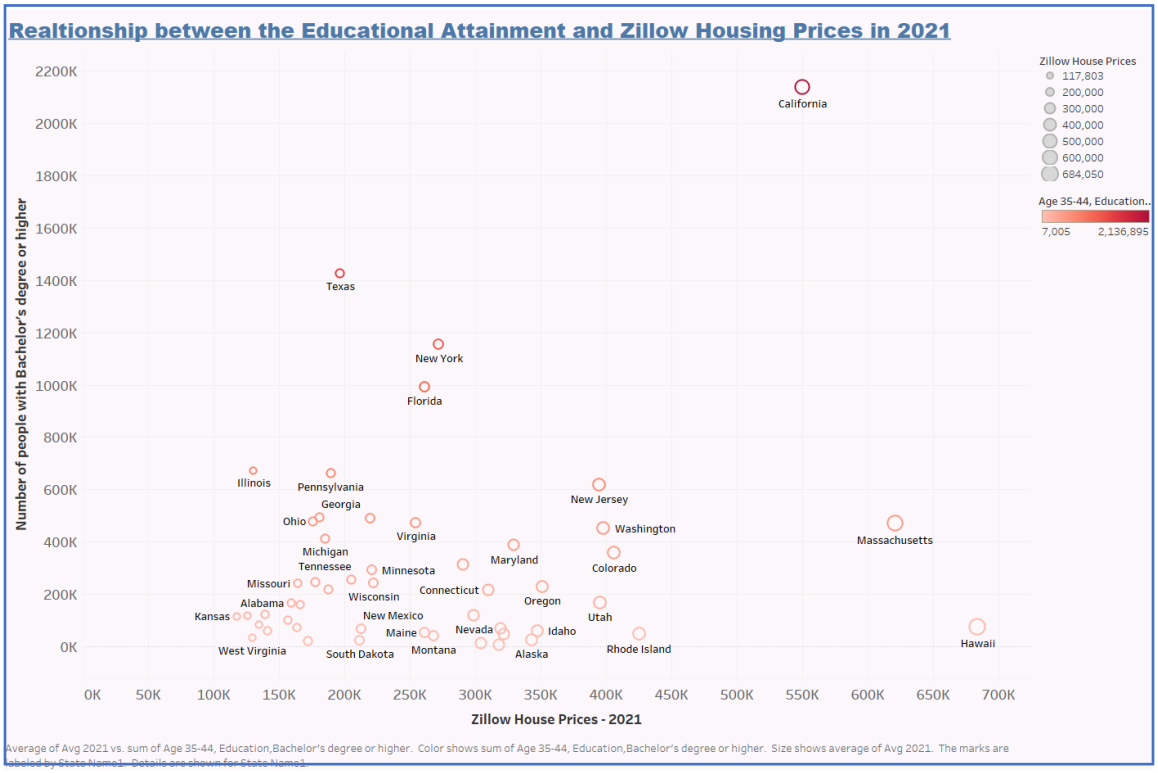


Figure 4: Relationship between the Educational Attainment and Zillow House prices 2021

- The scatter plot in Figure 4 shows there is not a strong direct relationship between a state's average Zillow home value and the number of residents with a bachelor's degree or higher.
- Hawaii had the highest average home value ($684,050) but only ranked 20th in educational attainment with 77,544 residents with a bachelor's degree or more.
- Massachusetts ranked 2nd in home values ($620,811) but 10th in educational attainment with 471,968-degree holders.
- California ranked 3rd in home values ($550,299) but 1st in educational attainment with over 2-million-degree holders.
- On the other end, Kansas ranked last in-home values ($117,802) but not in educational attainment, with 116,045-degree holders.
- Wyoming ranked 50th in educational attainment with just 7,005-degree holders, and its average home value was $318,140.
- In summary, there are states like California that rank high in both categories, but overall, the data shows there is not a strong direct correlation between high home values and high educational attainment on a state level.

5) How did average house values in 2022 for counties in Florida compared to counties in Texas?

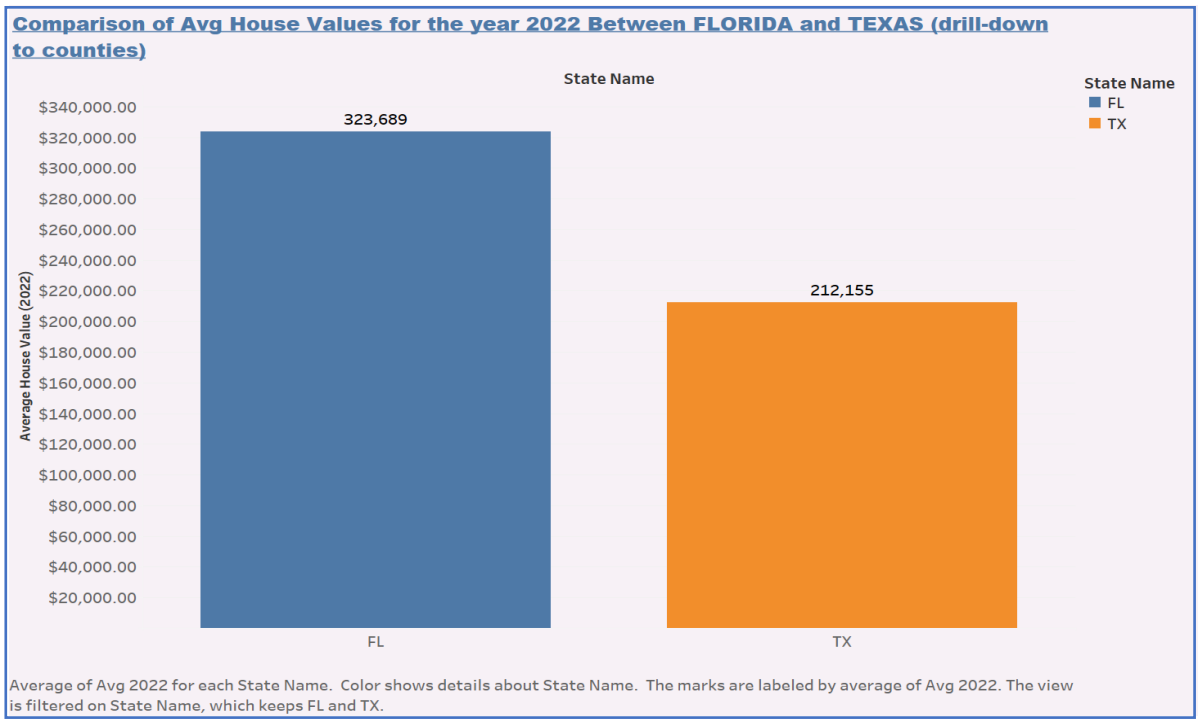


Figure 5: Average Zillow House Values in Florida and Texas in 2022

- The bar chart in Figure 5 compares the average Zillow house prices in 2022 between Florida and Texas at the state level. Florida had a higher average price of $323,689 compared to Texas which had an average of $212,155.

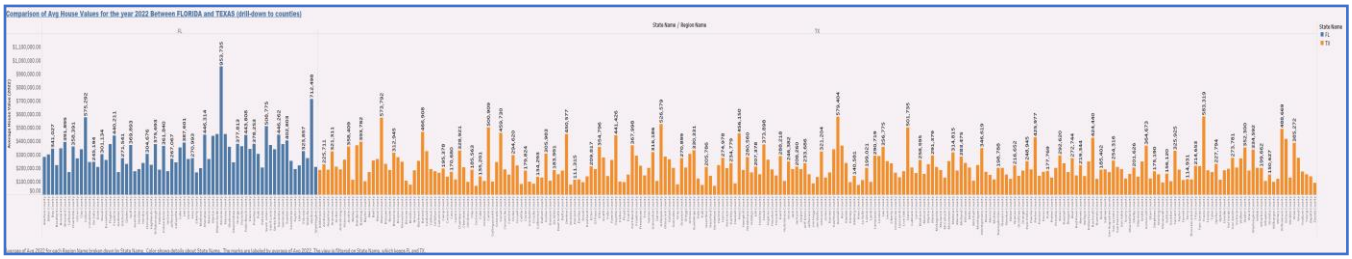


Figure 6: Average Zillow House Values in Florida and Texas in 2022 (Drilled down to counties)

- Drilling down to the county level, the bar chart reveals significant variation in average Zillow home values within Florida and Texas. In Florida, Monroe County had the highest average home value at $953,735, over 5 times more than Gadsden County, which had the lowest average value of $167,059.
- Similarly for Texas, Travis County had the highest average value of $583,318, nearly 9 times more than Cochran County with the lowest average of just $64,855.

6) How did changes in average per capita income from 2020 to 2021 relate to changes in average Zillow house prices and total population for Alabama, California, Florida, and Georgia?

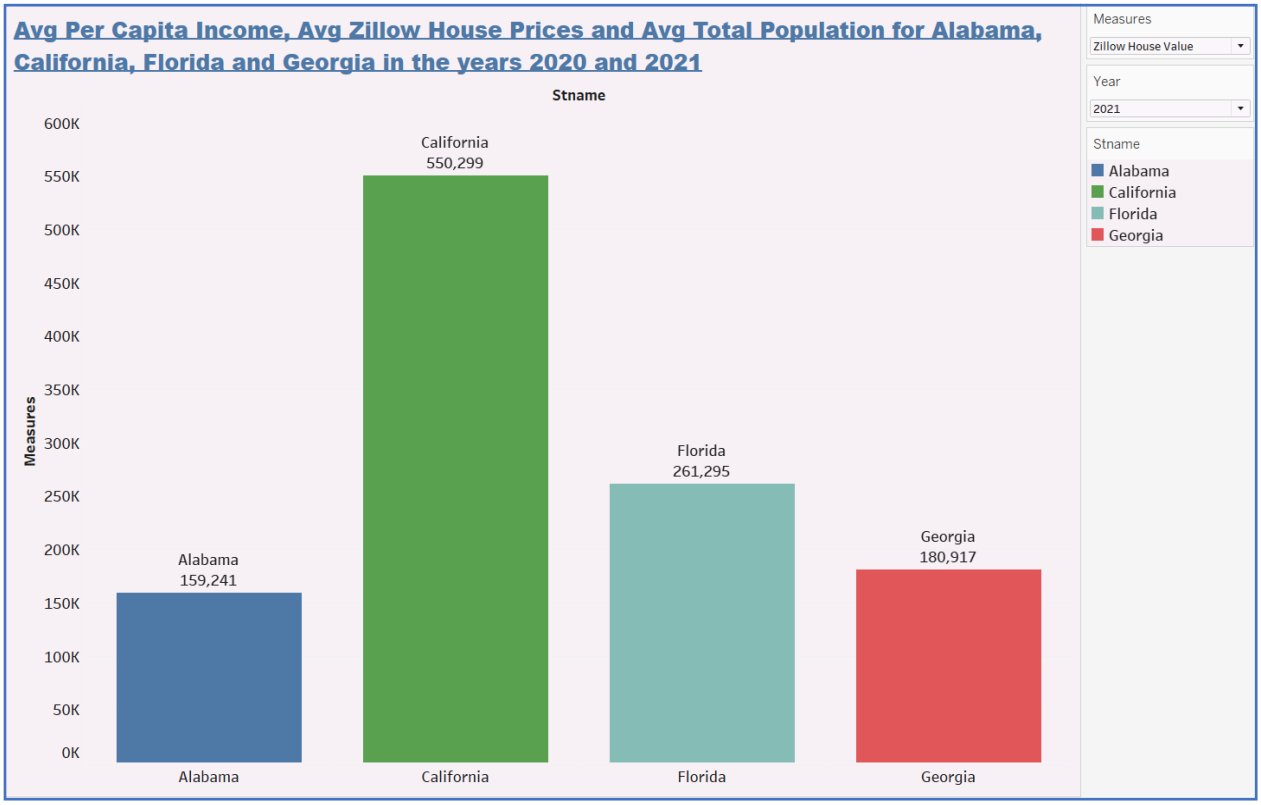


Figure 7: Comparison of Measures in Alabama, California, Florida, and Georgia in 2020 and 2021

- The bar chart in figure 7 compares key metrics - Per Capita Income, Zillow House Value, and Population - for the states of Alabama, California, Florida, and Georgia in 2020 and 2021.
- In 2020, California had the highest Per Capita Income at $62,376 while Alabama had the lowest at $40,767. For Zillow House Value, California again led with $477,430 versus Alabama's $140,811. California also had the largest Population at 1,339,039 residents compared to Alabama's 134,123.
- The trends were similar in 2021. California continued to lead in all three metrics - its Per Capita Income grew to $66,942; Zillow Value rose to $550,299, and Population was 1,326,881. Alabama remained at the bottom for income at $44,408 and housing value at $159,241, though its Population slightly increased to 134,850.
- Overall, the data shows California outpacing the other states by a significant margin in terms of wealth and population size from 2020 to 2021, while Alabama lagged across the board.
- There appears to be a strong positive correlation between Per Capita Income and Zillow House Value when compared between the sates Alabama, California, Florida, and Georgia. California has the highest income and housing values, while Alabama has the lowest. As income increases, housing values also tend to increase.

7) What is the association between the percentage change in population and the percentage change in median home values from 2020 to 2022 across different U.S. states?

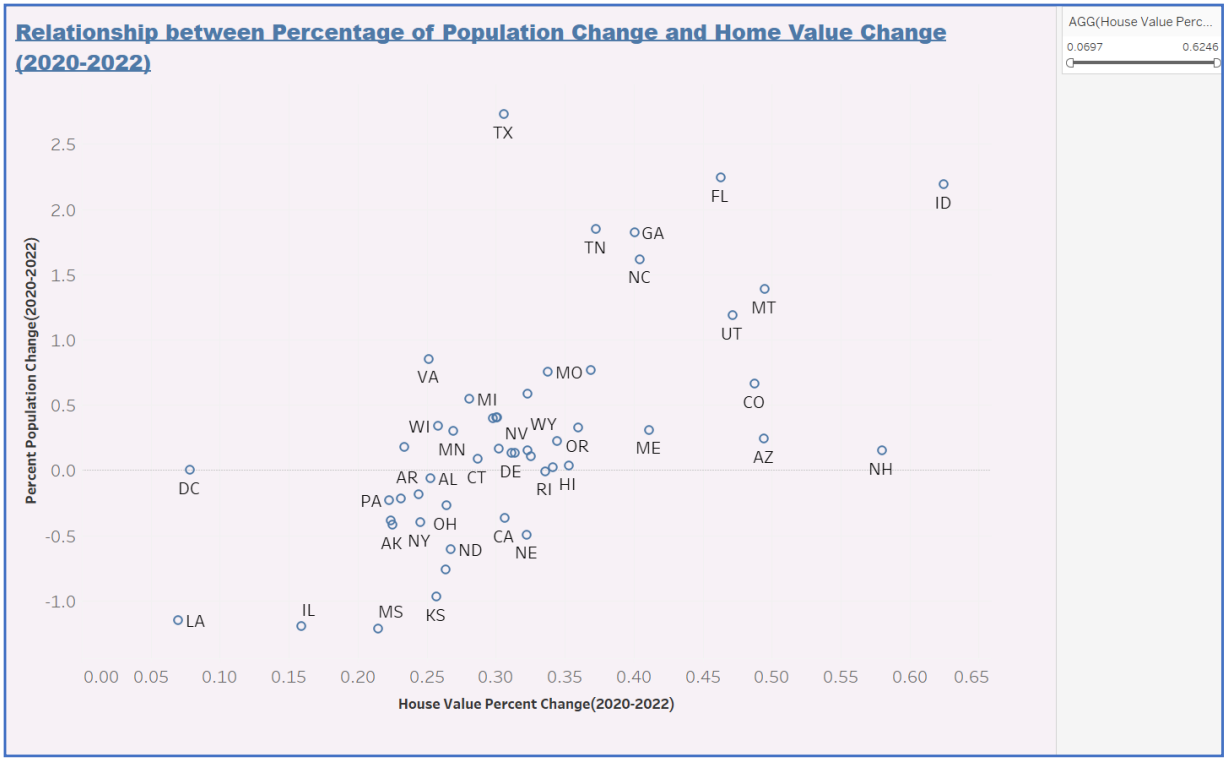


Figure 8 : Relationship between percentage of population change and home value change (2020-2022)

- The scatter plot in figure 8 depicts the relationship between the percentage change in population and percentage change in Zillow home values from 2020 to 2022 for each U.S. state.
- Idaho had the highest percentage increase in Zillow home values at 0.62%, but its population growth of 2.18% was not the highest.
- Louisiana had the smallest percentage increase in Zillow home values at 0.06% and a negative percentage change in population of -1.147%.
- Texas had the highest percentage population growth at 2.726% but did not have the highest growth in Zillow home values, which was Idaho at 0.62%.
- Mississippi had the most negative percentage change in population at -1.21%, but its growth in Zillow home values of 0.24% was not the lowest.
- So, in summary, while not a perfect correlation, there appears to be some relationship between population patterns and housing market shifts. High population growth states tended to experience stronger home appreciation, while population declines were associated with slower home value growth.

8) What are the minimum home values across U.S. states based on Zillow data for 2023?

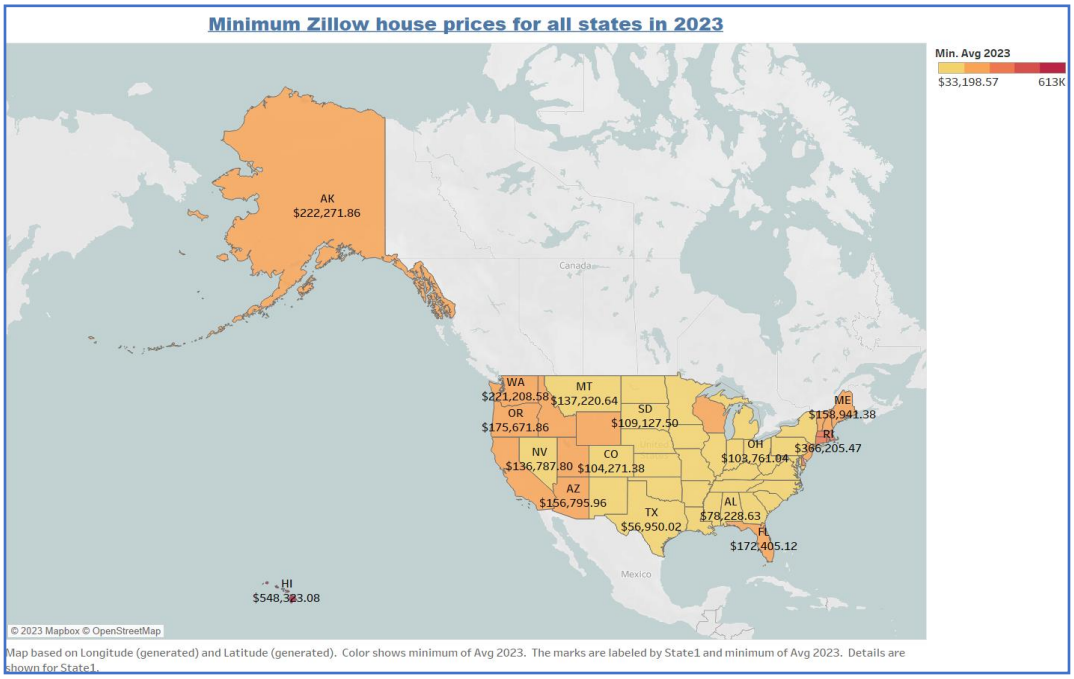


Figure 9: Minimum Zillow Home Values for all states in 2023

- The map in Figure 9 displays the minimum Zillow home values across U.S. states for 2023, based on data from Zillow Research. The state with the lowest minimum Zillow home value is Illinois at $40,158, while Hawaii has the highest at $548,323.

Per Capita Income, Zillow House Prices, and Population of all US states in the years 2020 and 2021

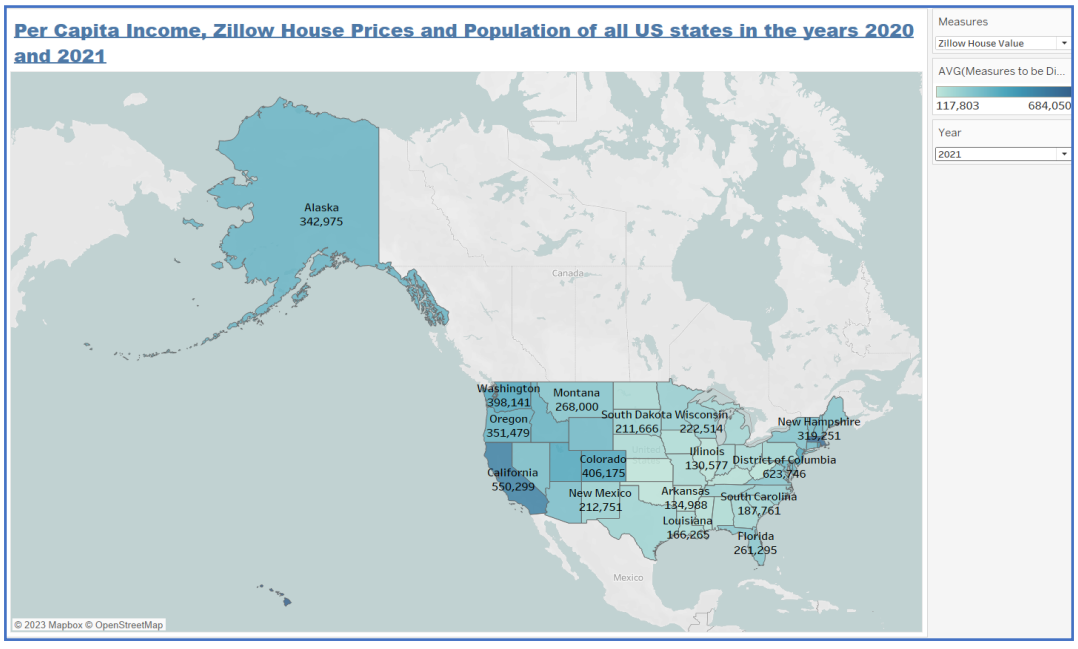
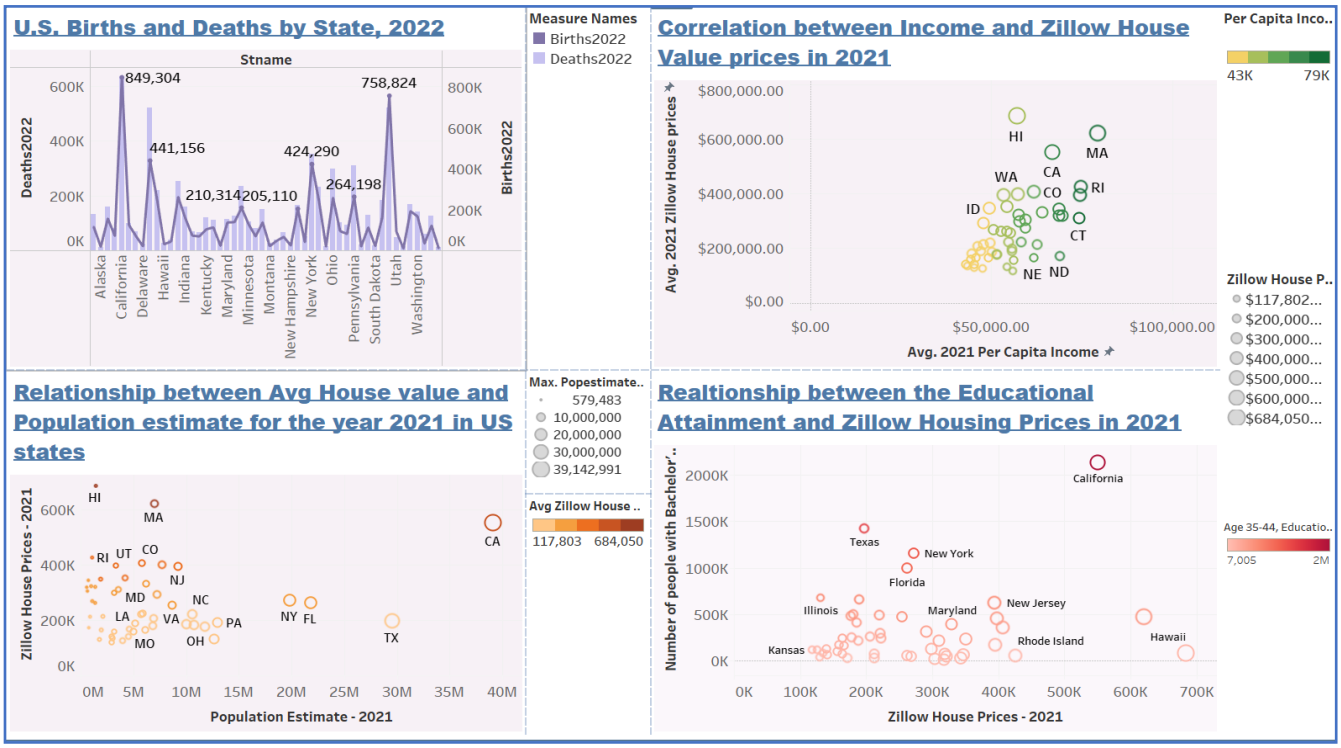


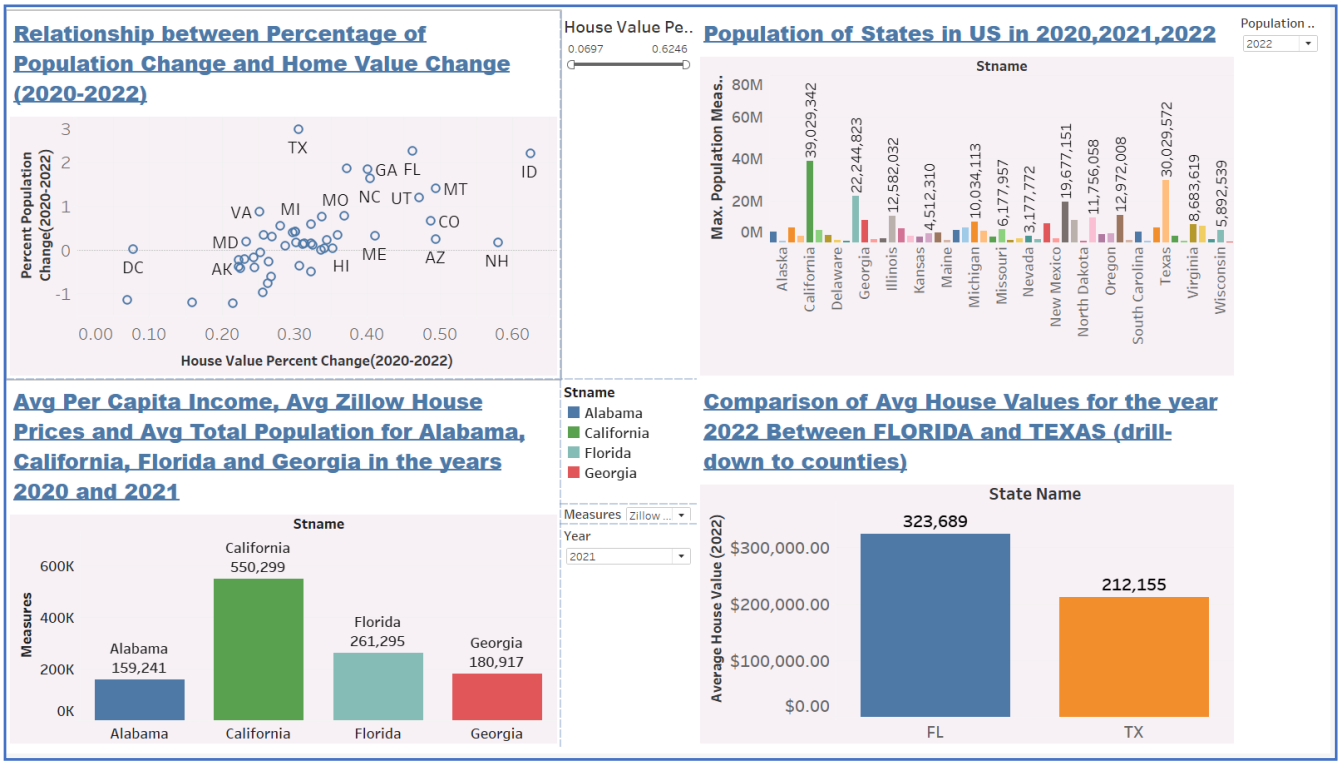
Figure 10: Measures in the years 202 and 2021

Dashboards:

1) Dashboard 1:



2) Dashboard 2:



4. CONCLUSION:

1) **Is there any relationship between the increase in the population and the change in house prices?**
    - Based on the data visualized in the scatter plot (Figure 8), there does appear to be some relationship between population increase and growth in home values, though it is not a perfect correlation. The states with the highest population growth, like Idaho and Texas, tended to experience larger increases in Zillow home values over the 2020-2022 period. Meanwhile, states with population declines, like Louisiana and Mississippi, saw slower appreciation in home values.
    - However, the relationship is not completely linear, as seen with Texas having high population growth but not the top home value appreciation. Overall, the data shows a general trend that higher population growth is associated with stronger housing market performance through rising home values, while population decline correlates with slower home price appreciation.

2) **Is there a relationship between changes in neighborhood income levels and home value appreciation over time?**
    - Based on the analysis of the scatter plot (Figure 3), comparing per capita income and average home values across U.S. states, there does appear to be a moderate positive correlation between income levels and home values. States with higher per capita incomes tend to have higher average home values, while lower income states tend to have lower home values.
    - However, the relationship is not perfectly linear, as seen with examples like Hawaii and Massachusetts where home values do not align precisely with income levels. There are clear outliers to the trend.
    - In summary, while higher neighborhood incomes are generally associated with higher home values, the relationship appears moderately correlated rather than a direct 1:1 link.
    - There are many other factors that contribute to home value appreciation over time beyond just income levels in a neighborhood. But a general positive relationship can be seen between incomes and home values based on this state-level analysis.

Additional Research Questions:

1) What is the relationship between changes in crime rates and home value growth over time in major metro areas? This could reveal if safety impacts prices.

2) How has climate risk, such as wildfire, flooding, or sea level rise exposure, impacted pricing over time in at-risk areas? This could quantify the environmental impact.