**U.S. Housing Constraints**

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**Introduction**

Housing constraints refers to factors that affect availability, cost, occupancy, and ownership of housing. In this project, we explored a number of such potential factors: household income, population growth, interest rates, building permits, unemployment, and education.

**Data**

* Datasets were pulled from Federal Reserve Economic Data (FRED) via its API (<https://fred.stlouisfed.org/>)
* Home Value data not available in 2004 for Montana and North Dakota
* 5 missing monthly Home Value data points were interpolated between adjacent months

**Home Value & Household Income**

We explored the relationship between home value and household income from 2004 to 2023. For median home values, the range between the highest and lowest states increased by 191% ($448,730) from 2004 to 2023, while the overall median for the U.S. increased by 112% ($180,759). The medians for the lowest five states (West Virginia, Kentucky, Oklahoma, Mississippi, Arkansas) had similar values to each other during this period with little fluctuation year-to-year. By contrast, the highest five states (Hawaii, District of Columbia, California, Massachusetts, New Jersey) had greater differences in median values relative to each other, as well as much greater volatility.

Linear regression plots of home value vs. household income for 2004 and 2023 resulted in R2=0.5643 and R2=0.4615, respectively. This shows a moderate correlation between household income and home value. More interestingly, the decrease in the correlation coefficient indicates that income had become less predictive of home value in 2023 compared to 2004. This may be concerning as income is the primary metric most home buyers use to gauge affordability.

A state’s affordability statistic is calculated as the ratio of median household income to median home value in a given year. For 2004, the five most affordable states are predominantly rural, while the five least affordable are more strongly urbanized, with the exception of Hawaii (which, being a tropical island chain with little available real estate, is expectedly less affordable).

In 2023, we observe some changes from 2004. First, affordability decreased throughout the United States. The top five states were still primarily rural, but now include Illinois. This is interesting because, while Illinois has considerable farmland, it is also home to Chicago, the third most populous city in the country, and we expect states with more urbanization to be less affordable. At the lower end, Hawaii overtook California as the least affordable. But it’s not good news for California, as its affordability also decreased, just not as much as Hawaii’s. Perhaps the most surprising observation for 2023 is that the rural state of Idaho became the third least affordable state.

From 2004 to 2023, 39 states decreased in affordability; only 10 states increased in affordability and of those, only five increased by more than 2%. Two states in particular stand out: Illinois, whose affordability increased by 34.5%; and Idaho, whose affordability decreased by 49.2%. Thus, our data supports the hypothesis that homes have become less affordable over this 20-year period.

**Housing Inventory**

New home listings had an annual compounded growth rate of about 0.96% from 2017 to 2023. Meanwhile the U.S. population grew at annual compounded growth rate of about 7.54% during that same period. The U.S. population has outpaced new home listings by roughly 8.5% (difference between the two growth rates). The U.S. housing constraints may be exacerbated by population growth outpacing the availability of new home listings, creating an imbalance in supply and demand. Here are the top five states with the highest number of new home listings:

A screenshot of a cell phone

Description automatically generated

And the bottom five states were:

A screenshot of a phone

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It was surprising to see Florida edging out California and New York for the top spot. It was also surprising to see Georgia listed in the top five versus Washington state or Massachusetts. None of the states that were listed in the bottom came as a shock. These are states that could have a lower demand for housing.

Examining the Wall Street Journal (WSJ) prime rate relative to building permits showed little correlation between these two data sets with R=0.0541. Building permits versus new home listings also had very weak correlation with R=0.0049. Interest rates do not seem to be a significant influence to obtaining new building permits and building permits have little impact to the new home listing count. Building permits could be obtained for reasons outside of home sales and could be obtained for personal usage.

Reviewing the number of U.S. home vacancies relative to home vacancies available for sale or rent shows that vacant homes available for sale or rent are a small fraction of the overall U.S. home vacancies. Vacant homes that are not available for sale or rent could be attributed to the following: uninhabitable homes (in need of repair or are currently being renovated), vacant homes held for speculative purpose, homes currently in development, or second home/vacation home. Vacant homes that are not available for sale or rent may also be a significant factor contributing to housing constraints in the U.S.

**Homelessness**

Throughout the 50 states, there have been 374,702 homeless people reported from 2007-2023. In the analysis, the number was divided by state in order to determine which states were worse than others.

The 3 states with the most homelessness were:

1. New York: 78,920
2. California: 57,468
3. Florida: 21,121

The 3 states with the lowest amount of homelessness were:

1. Wyoming: 405
2. North Dakota: 548
3. Mississippi: 626

The total range of this dataset was 78,515.

**Unemployment Rates**

We calculated the mean and the median of the unemployment rates for each state every year from 2004-2024. The mean rates were typically higher than the median rates across most states.

Unemployment rates seemed to skyrocket immediately following the 2008 crash, hitting its peak around 2010. After this, it steadily declined until 2020, where it had another spike, possibly due to Covid-19, and then dropped back down in the following years.

We also explored the relationship between the median unemployment rate and the median income for the country, but there was little correlation in the data, with the R=0.296. The correlation between the median unemployment rate and the median homeownership rate was similar with R=0.257, also a very weak correlation. Based on these findings, the unemployment rates don’t seem to have much of an effect on income or homeownership rates in the United States.

**Higher Education**

The average higher education level shows a steady upward trend. This represents a consistent growth in educational attainment over the 17-year period of 2006-2022, with a particularly notable increase around 2020. There are no significant drops or sharp declines, indicating a stable upward trajectory. States such as California and Florida show relatively stable distributions where the median line stays in a similar range, indicating consistent higher education rates over time. The histogram for states like District of Columbia (DC) shows a much larger range, indicating that the higher education rate varies significantly across the years.

The highest point in homeownership is seen in 2006, before a gradual downward trend begins. Homeownership dropped significantly after 2008. This could be attributed to the 2008 housing crisis.

Analyzing the percentage year-over-year change of higher education and homeownership, significant growth in both was seen in 2020 and significant decline occurred in 2021, before rebounding in 2022.

The distribution of U.S. homeownership is largely symmetrical and consistent across the data points, whereas higher education shows a slightly broader spread, with mild skewness toward higher values. There are no outliers in either dataset based on the 1.5 × IQR rule. Both datasets are relatively consistent and fall well within the expected range for their respective measures.

Regarding regional trends, the South region has higher homeownership rates but a relatively lower rate of higher education. On the other hand, Pacific regions show the reverse: a relatively higher rate of higher education but lower homeownership.

**Conclusions**

Of the housing constraints studied in this analysis, the highest correlation discovered was household income in relation to home values. Interest rates and building permits appear uncorrelated with housing inventory, while unemployment and higher education have little correlation with homeownership.

Other observations include: a marked decline in home affordability, population growth outpacing new home listings, home vacancies greatly exceeding housing for sale or rent, a massive gap in homelessness between states, and the impact of the 2008 housing crisis and COVID era on homeownership.