

A Look at the U.S. Housing Affordability

Using Zillow Group's Data (1979-03 to 2018-06)

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Outline

Geography

Which metropolitan areas are the most expensive by

1. Price-to-Income Ratio
2. Mortgage Affordability
3. Renter Affordability

Historical Trend

How has housing affordability changed over time?

1. Largest increase
2. Trajectories
3. House Price Boom & Crisis of 2008

Correlation

Are the 3 housing affordability indices correlated?

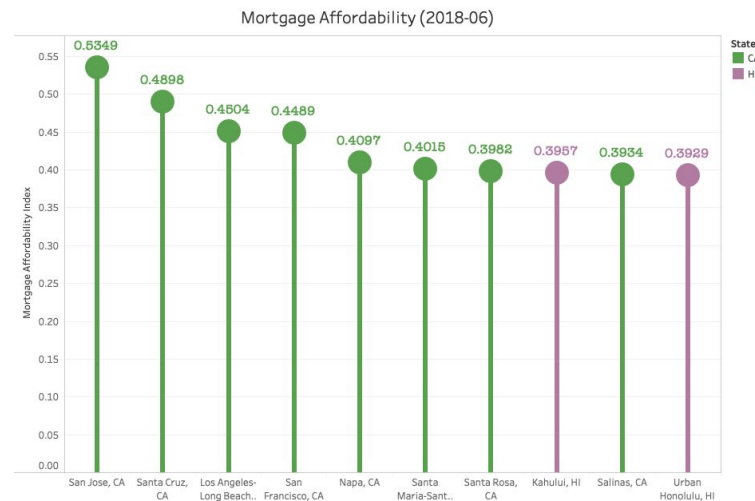
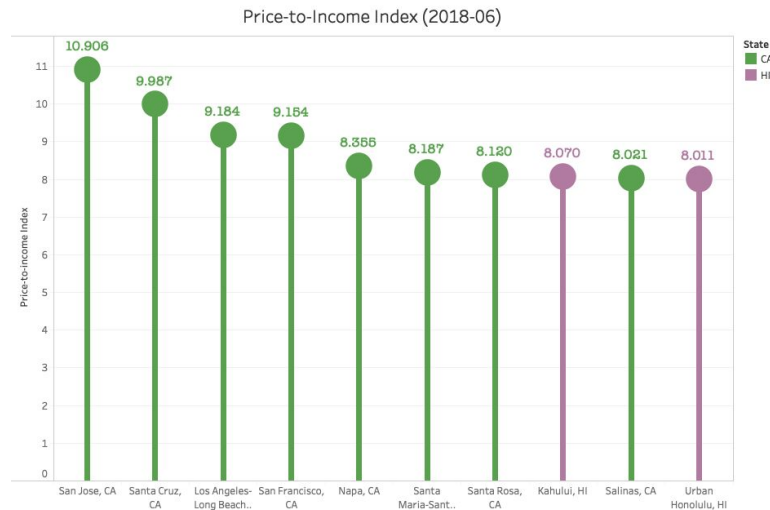
Geography

Lollipops & Maps

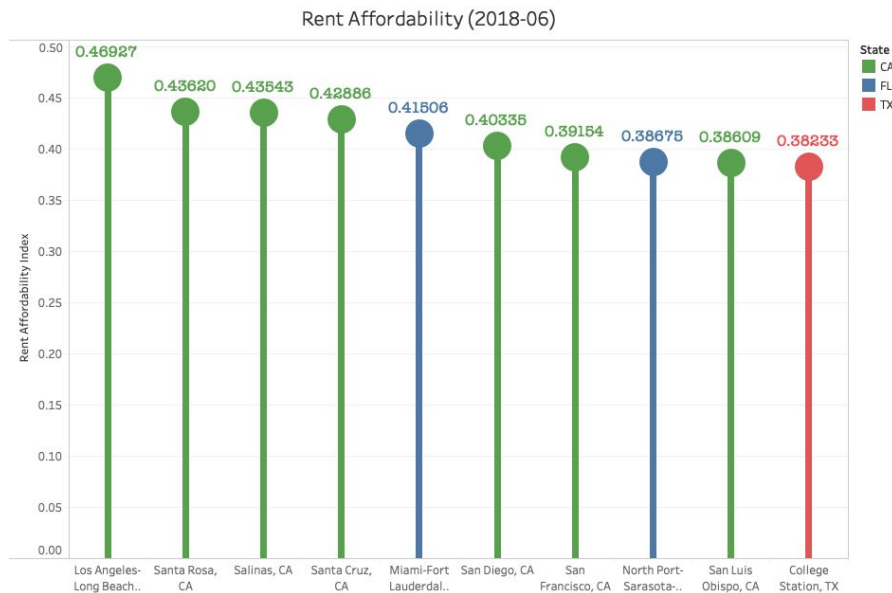
Which Metropolitan Areas Are the
Most Expensive to Live?

Geography

- The metropolitan areas are ranked by Price-to-Income Ratio, Mortgage Affordability and Renter Affordability using *June 2018* data
- Observe that, by **Price-to-Income Ratio** and **Mortgage Affordability**, cities in **California** take the lead in the Top 10 (8 out of 10), with 2 Hawaiian cities following
- All cities are located in the West



Geography

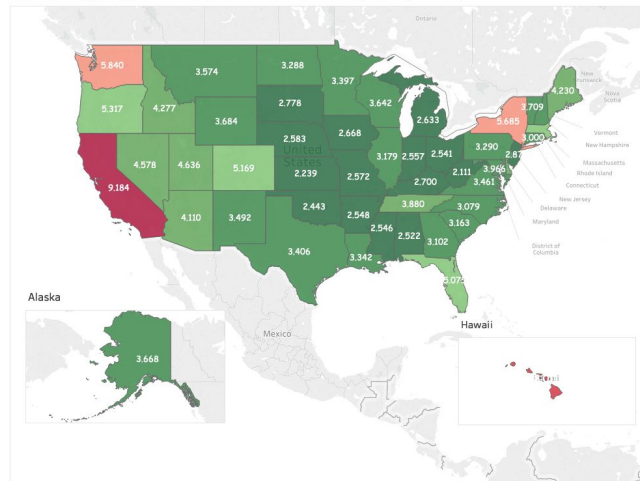


- Ranked by **Rent Affordability**, the Top 10 cities see slightly more diversity in term of geography, yet **Californian** cities still have a heavy presence

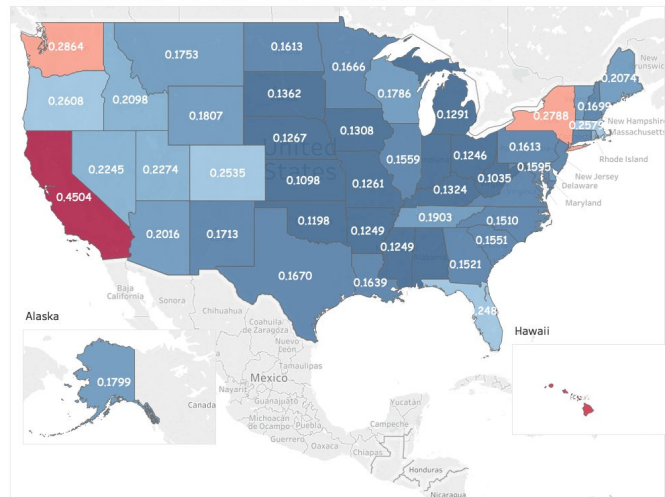
Geography

- For each state, project the affordability indices of the **most populous** metropolitan areas onto maps
- In terms of **Price-to-Income Ratio** and **Mortgage Affordability**, CA, WA, NY and HI are significantly more expensive to live in than the rest of the country

Price-to-income Index in the Largest Metropolitan Area by State (2018-06)



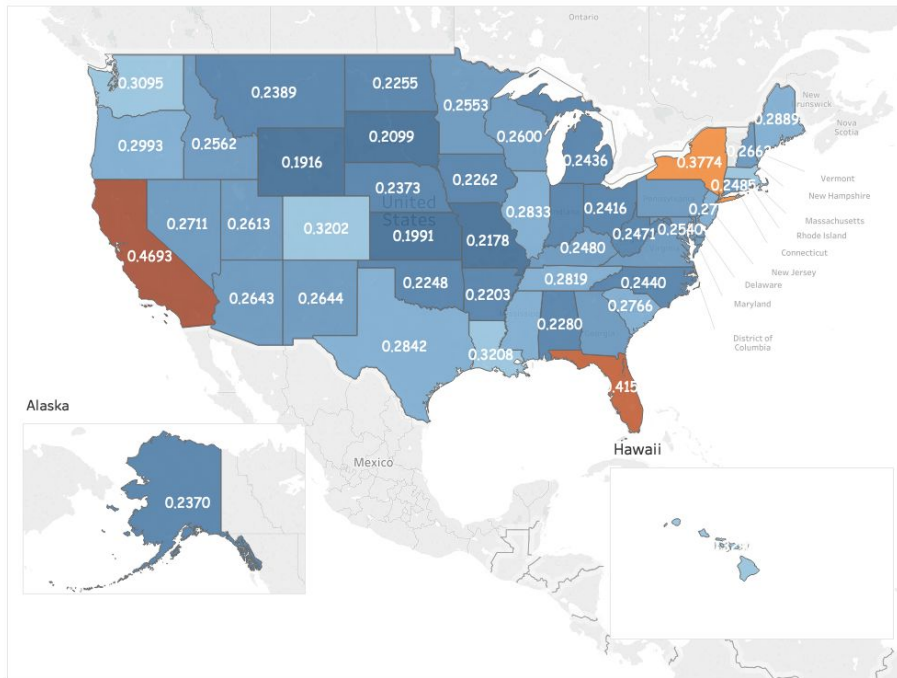
Mortgage Affordability in the Largest Metropolitan Area by State (2018-06)



Geography

- By **Rent Affordability**, in contrast, **CA**, **NY** and **FL** beat other states by a large margin
- Housing in Central U.S. is generally more affordable in comparison to coastal states

Rent Affordability in the Largest Metropolitan Area by State (2018-06)



Historical Trend

Tree Maps & Interactive Time Series

How Has Housing Affordability
Changed over Time?

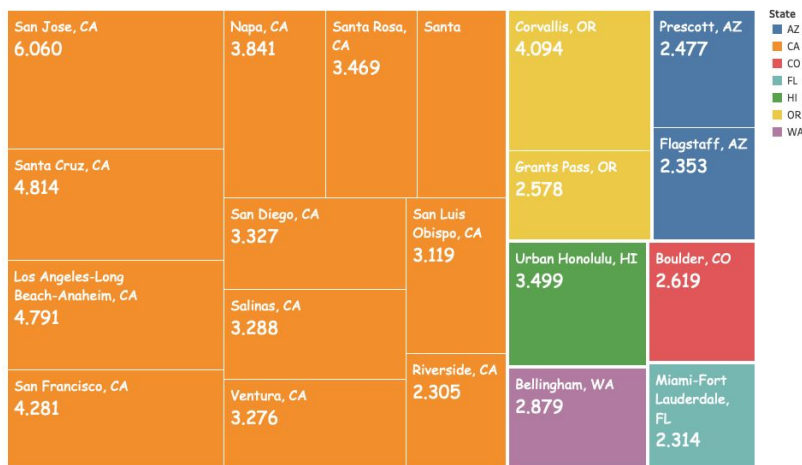
Again, by Geography

- The tree maps exhibit the **Top 20** metropolitan areas that experienced the **highest growth** in the 3 affordability indices from 03/1996 to 06/2018 (since 03/1996 there has been a relatively complete record of data)

Top 20 Metropolitan Areas in Increase in **Mortgage Affordability** (03/1996 - 06/2018)



Top 20 Metropolitan Areas in Increase in **Price-to-income Index** (03/1996 - 06/2018)



- Similar to the previous section, **California** again dominates, suggesting that in general the state has seen a universal and large increase in real housing price (accounted for the growth in income)
- The Wild Wild West - western states take up **80-90%** of the list

Again, by Geography

- In terms of **Renter Affordability**, on the contrary, there is substantially more geographic diversity

Top 20 Metropolitan Areas in Increase in **Renter Affordability** (03/1996 - 06/2018)



Change Over Time

- **NOTE:** These 3 graphs are interactive time series plots. You may open it in the Jupyter Notebook to interact with the plots by moving around your cursor
- 5 metropolitan areas & the national-level data are selected for plotting based on their rankings in **population**. Specifically,

Max - New York, NY

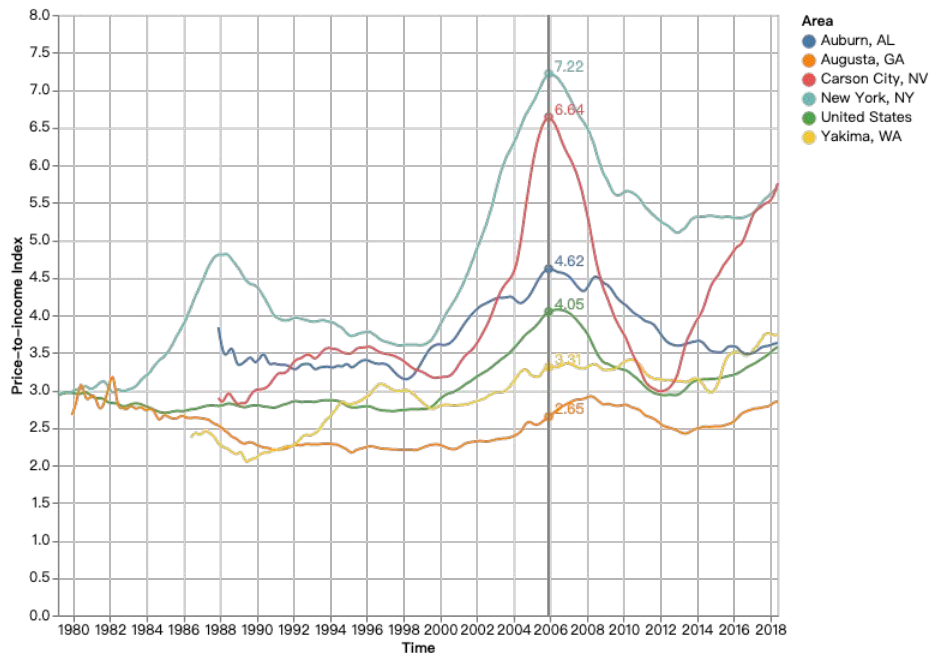
25% - Augusta, GA

Median - Yakima, WA

75% - Auburn, AL

Min - Carson City, NV

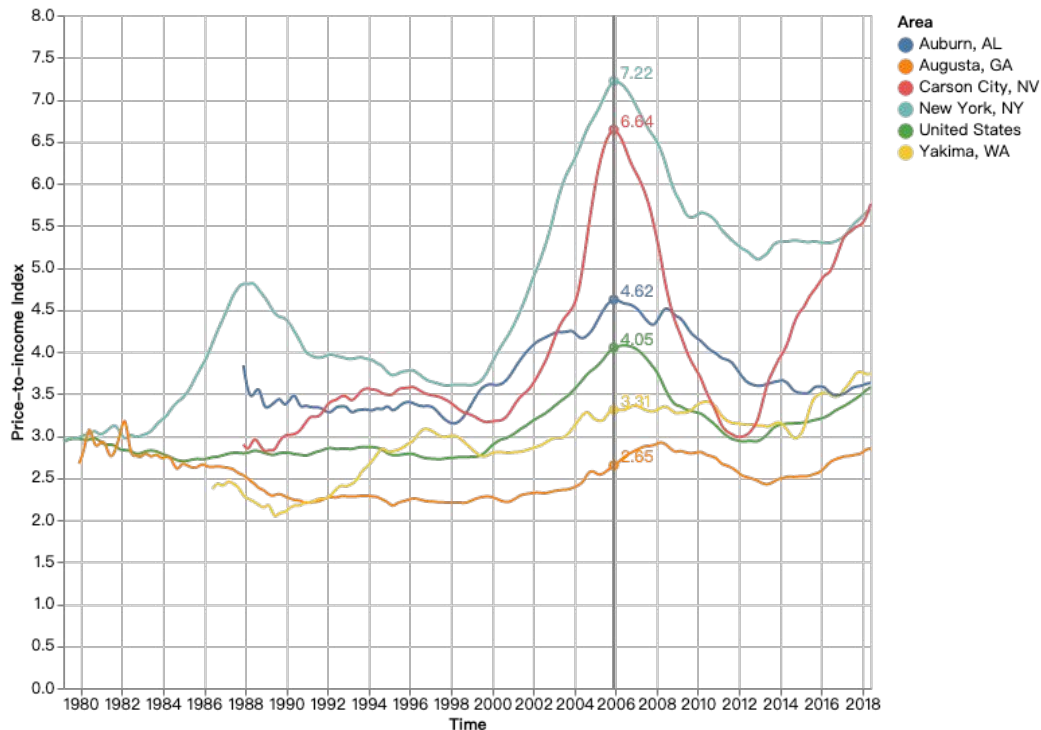
Price-to-Income Ratio from 1979-03 to 2018-06



Price-to-Income Ratio

- 1979 - 2000: Relatively **stable** level of Price-to-Income Ratio (with the exception of New York City)
- 2000 - 2007: **Phenomenal increase** in Price-to-Income Ratio across the U.S.
- 2007 - 2013: **Collapse** in Housing Price
- 2013 - 2018: **Recovery** from the Recession (with Carson City's Price-to-Income Ratio soaring)

Price-to-Income Ratio from 1979-03 to 2018-06



Mortgage Affordability

Mortgage Affordability from 1979-03 to 2018-06

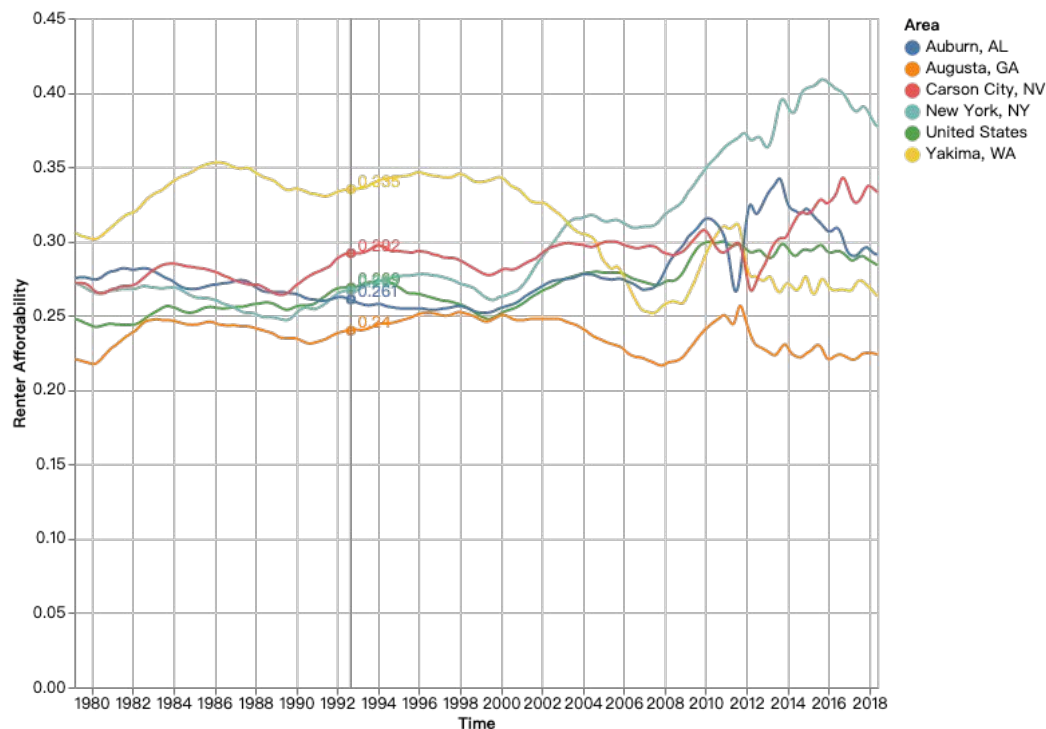


- Mortgage affordability is characterized by constant fluctuation
- A general trend exists, but short-term up-and-downs are prevalent
- The plot behaves similarly to the **Price-to-Income Ratio** plot, with the mortgage affordability index reaching its peak in 2006-2007 across the country and plummeted

Renter Affordability

- Renter Affordability is marked by **stability** and **low variance** across cities over the years 1979-2008
- Did not experience the boom and bust over 2000-2013 as opposed to Price-to-Income Ratio and Mortgage Affordability
- Nevertheless, after the Crisis of 2008, renter affordability turned **more volatile** and saw **more variation** among different metropolitan areas

Renter Affordability from 1979-03 to 2018-06



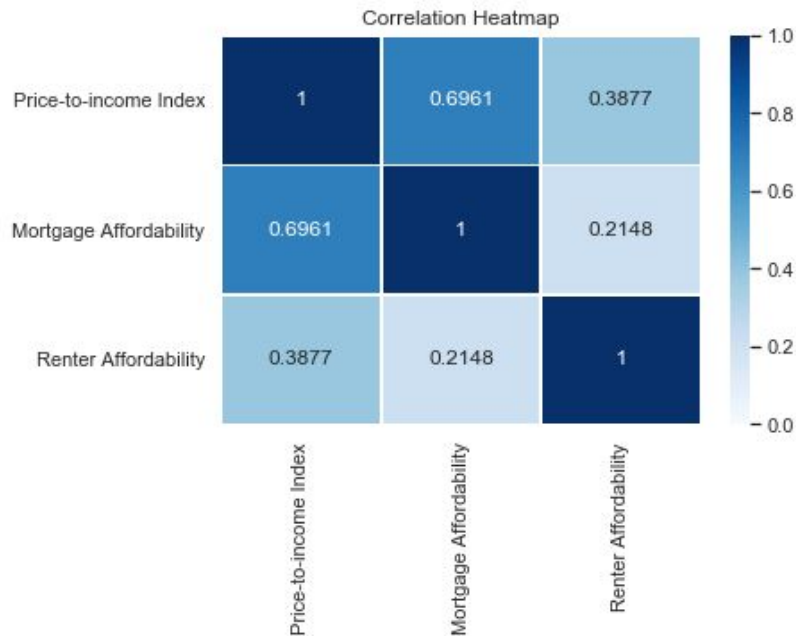
Correlation

Heatmap

Are the 3 Housing Affordability
Indices Correlated?

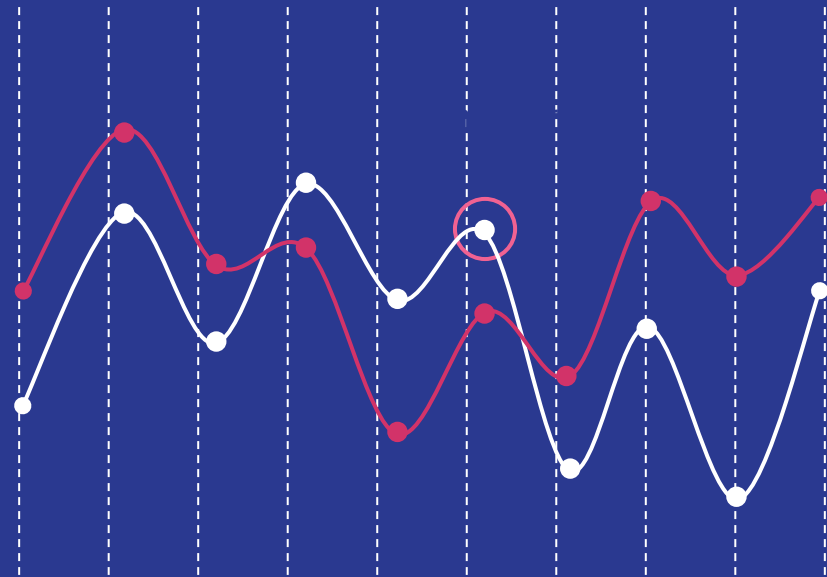
Correlation Heatmap

- Previously noticed a pronounced consistency between **Price-to-Income Ratio** and **Mortgage Affordability** in graphs/plots
- Created a correlation heatmap among the 3 indices using data from 1996-03 to 2018-06
- Result
 - **Price-to-Income Ratio** and **Mortgage Affordability** have a correlation of **0.6961**, which agrees with our observation
 - Correlations between other two pairs of indices are insignificant



Conclusion

From Visualizations to Insights



Conclusion

- Western states (**California**, above all) are the least welcoming in terms of housing affordability if you seek to purchase a house
 - Also, western states experienced the greatest increase in real housing prices over the past 13 years
 - Interestingly, **Florida** has a notable presence in rents and increase in rents over time
- During the period from 2000 - 2007, the real U.S. housing prices and mortgage saw a universal boom, crashed, and gradually recovered. In contrast, rents enjoyed stability until 2008, where they became volatile
 - In general, the **Price-to-Income Ratio** and the **Mortgage Affordability** display highly **consistent** behaviors, while **Renter Affordability** behaves more **independently**