EDA Mini Project-I

House prices and population growth

S470/670

Introduction

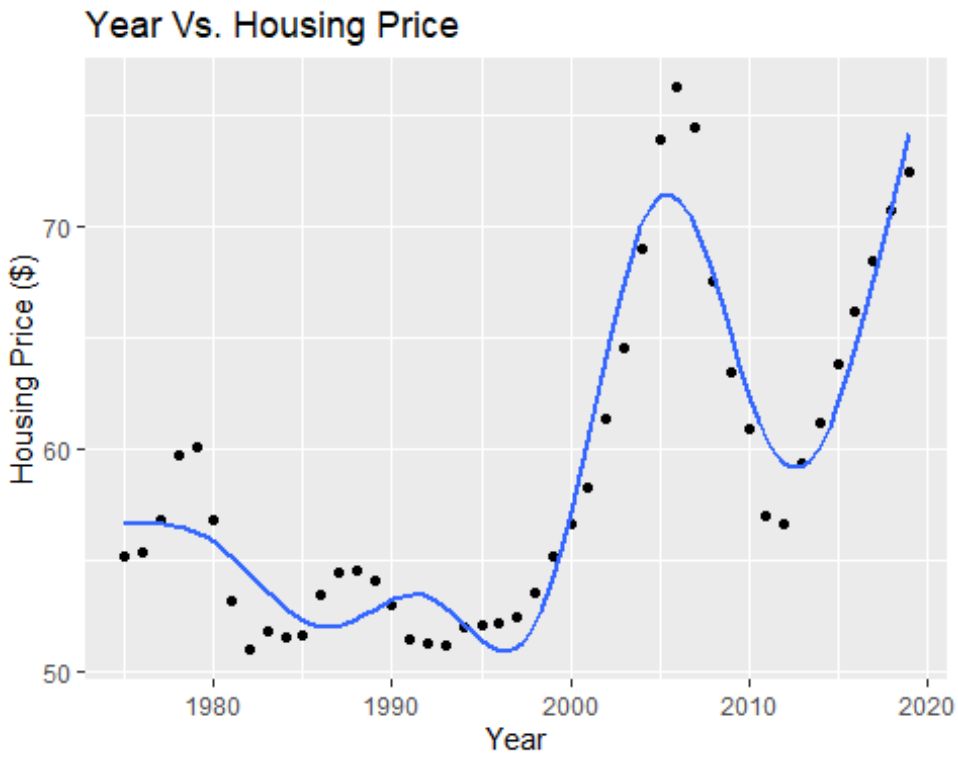
The project mainly focuses on how have house prices in U.S. states changed over the last few decades, and does changes in prices depend upon population to some extent. It seems instead that house prices do depend upon population density i.e. population per area.

House prices over time

Adjusting for CPI:

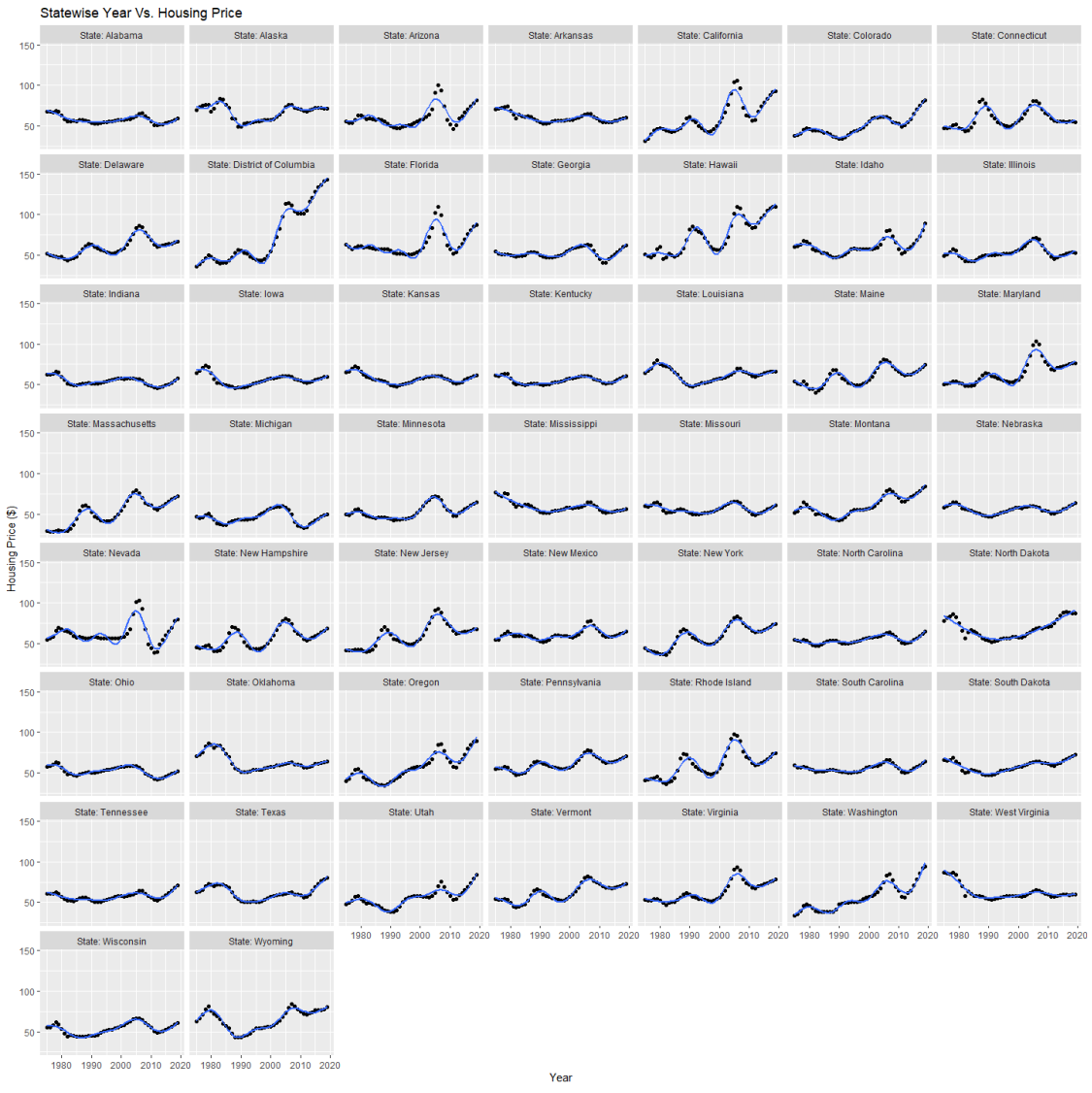
CPI measure change in price level of good and services i.e. it correlates to the purchasing power of a consumer. The house prices have been CPI adjusted i.e. change in currency values and inflation have been considered. Below is the figure representing relation between Housing price over the years.

Figure 1: Change in prices US (CPI adjusted)



Year vs House Price: There are fluctuations in Housing Prices over the time period. The sharpest change (increase) in House prices can be seen be seen after 1995. These prices have been adjusted as per inflation hence the increase in value of currency has been taken into account. One more observation that can be derived is that the house price fluctuation is much more in the 2000s as compared to period 1975-2000. This can be interpolated to the fact of more economic dynamics in the recent years. There can be a correlated to increase in globalization and changes in market dynamics.

Figure 2: changes in price varied by state

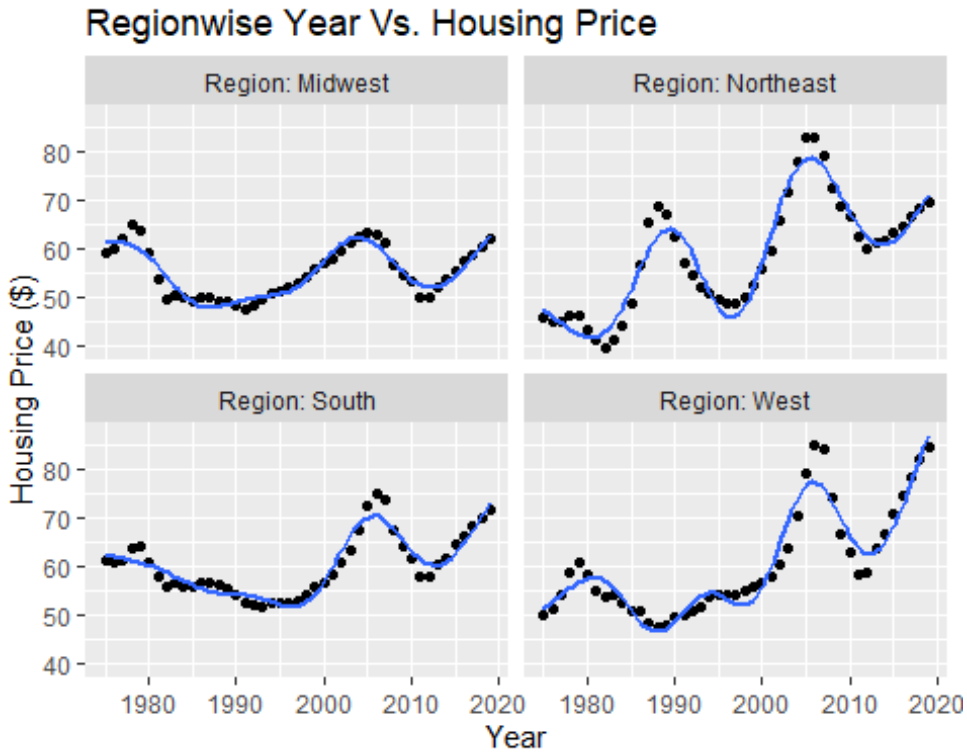


Different states showcase different relationships with house prices. Although each state obviously has a distinct curve that depicts relation between house prices and year, the underlying structure remains the same (showing an overall increase in price over the years). The district of Columbia has seen the biggest increase and Nevada has seen the maximum decrease in house prices. One state that can be equated as an outlier is West

Virginia since its overall trend depicts a decrease in house price instead of increase, over the time span.

To further continue the examination, region wise plots have been made where all states are clubbed into 4 regions and the pattern of house prices are studied with respect to the 4 regions.

Figure 3: Changes in prices when studied region-wise

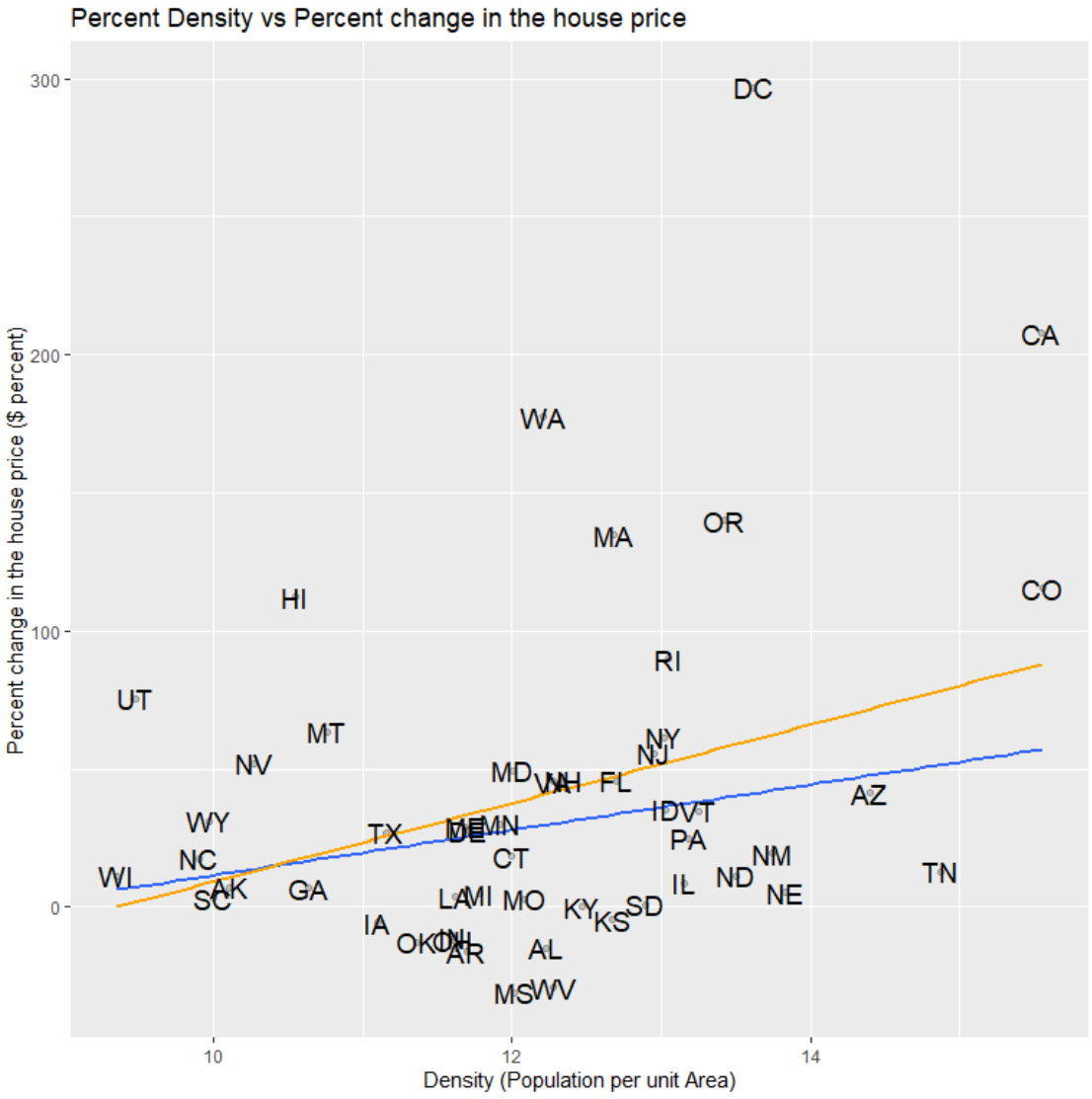


As seen region-wise, all the regions depict a similar trend of increase in house prices over the years especially in the later 2000s except Midwest which shows an overall flat trend as compared to all other regions. However, talking about absolute prices each region has its own numbers with West being the priciest of all, closely followed by Northeast. Midwest and South show quite identical trends though Midwest has an overall negligible change in house prices over the span of years.

Population density and changes in house prices:

Next analysis has been done between percent changes in house prices and population density. Population density has been considered which is population of the state per area.

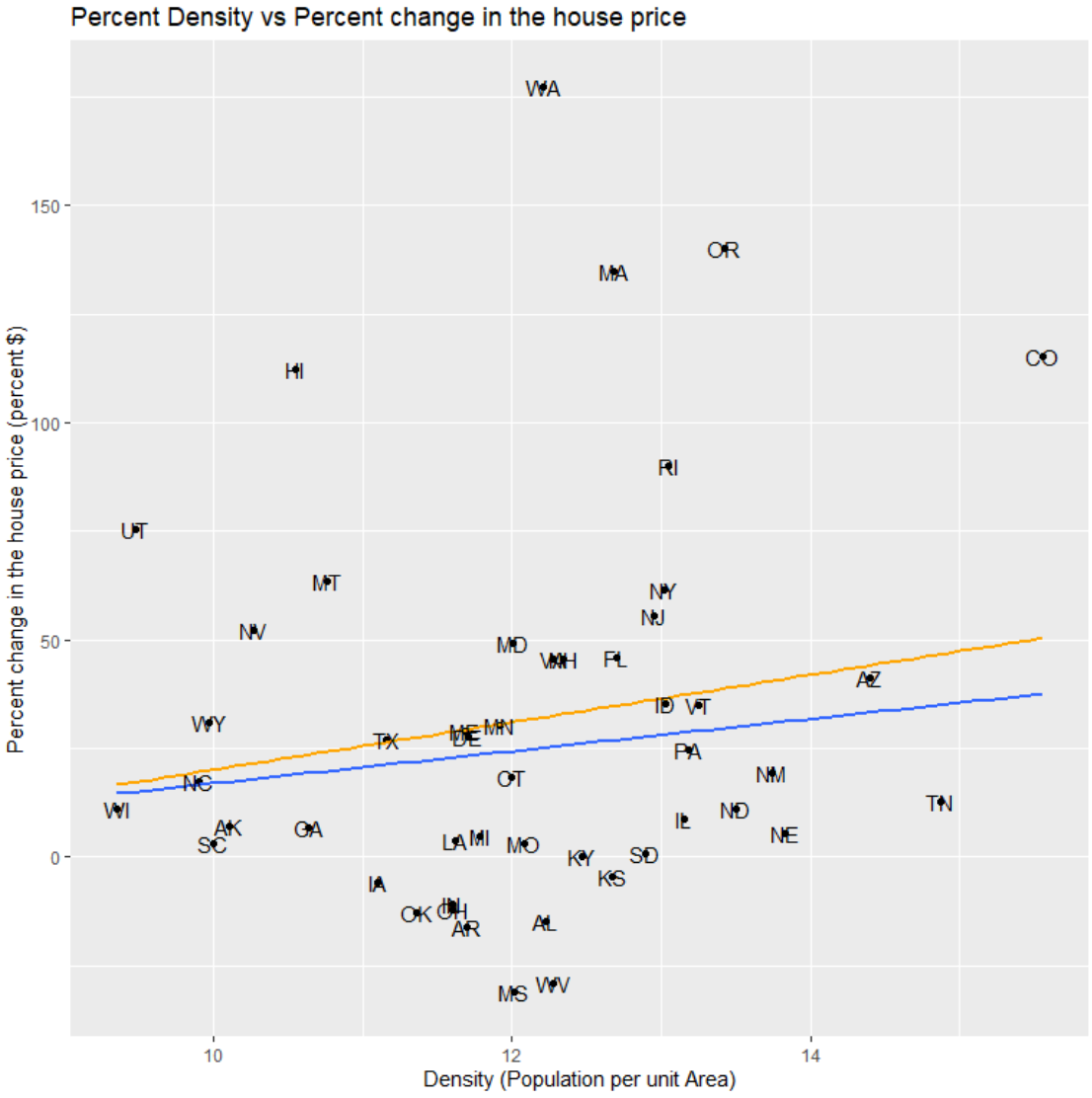
Figure 4: population density vs change in house prices



Though this graph gives a some what clear picture, it can be observed that 2 of the states are clear outliers. Hence California and DC have been removed and a next plot has been

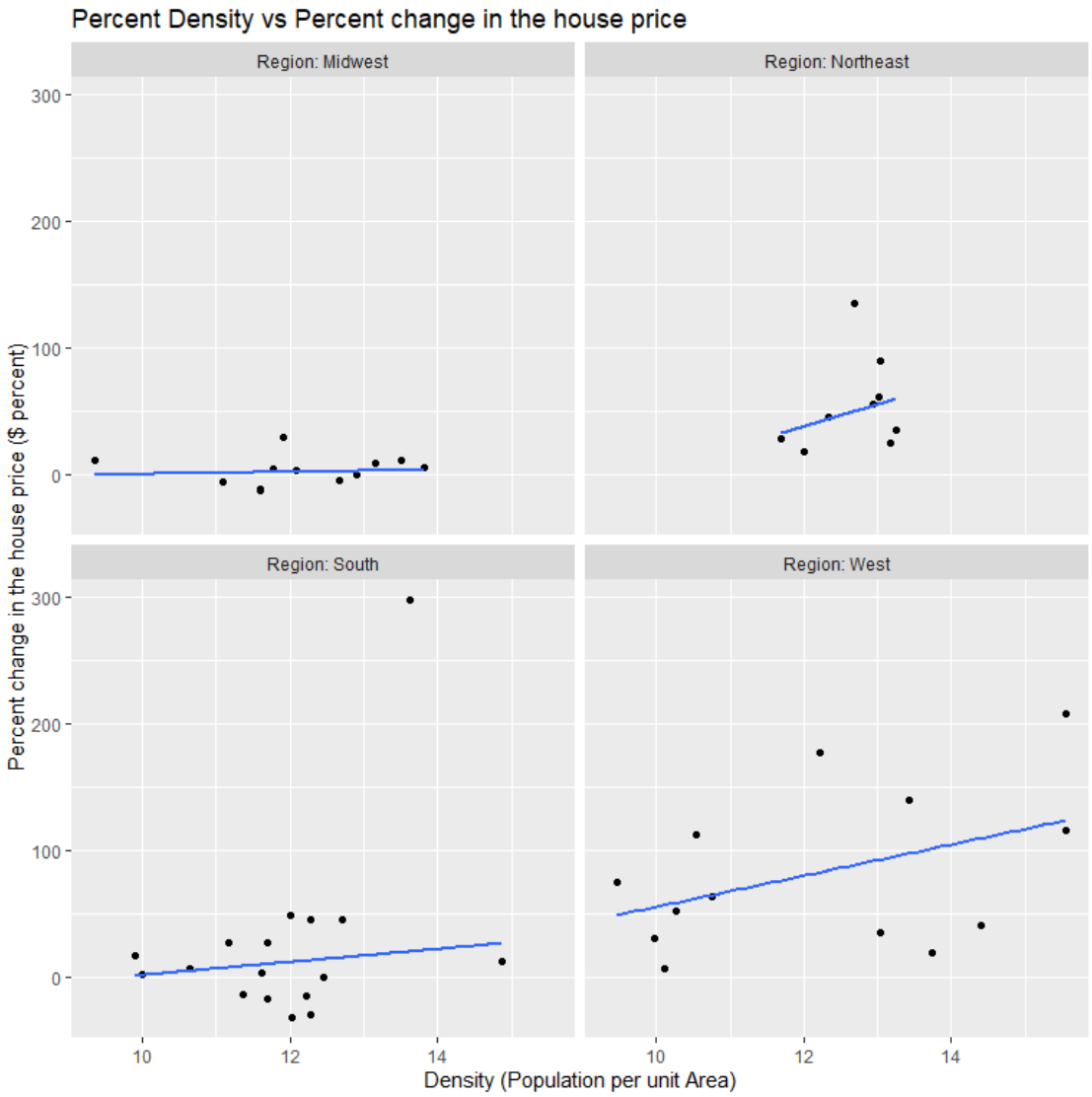
obtained. These cities are highly developed economic zones and do not follow the overall general trend given by the rest of the states of US

Figure 5: population density vs change in house prices after removing outliers



With increase in density there is an increase in percent change in house prices. There are 2 outliers of DC and California which have been downweighed. This is done so because these 2 states do not follow the trend and change in house prices is extremely high. After this process the hypothesis is bolstered that with increase in density there is an increase in percent change in house prices. The removal of outliers considerably reduces the change in house prices.

Figure 6: Change in House Prices vs Population Density (Region Wise)

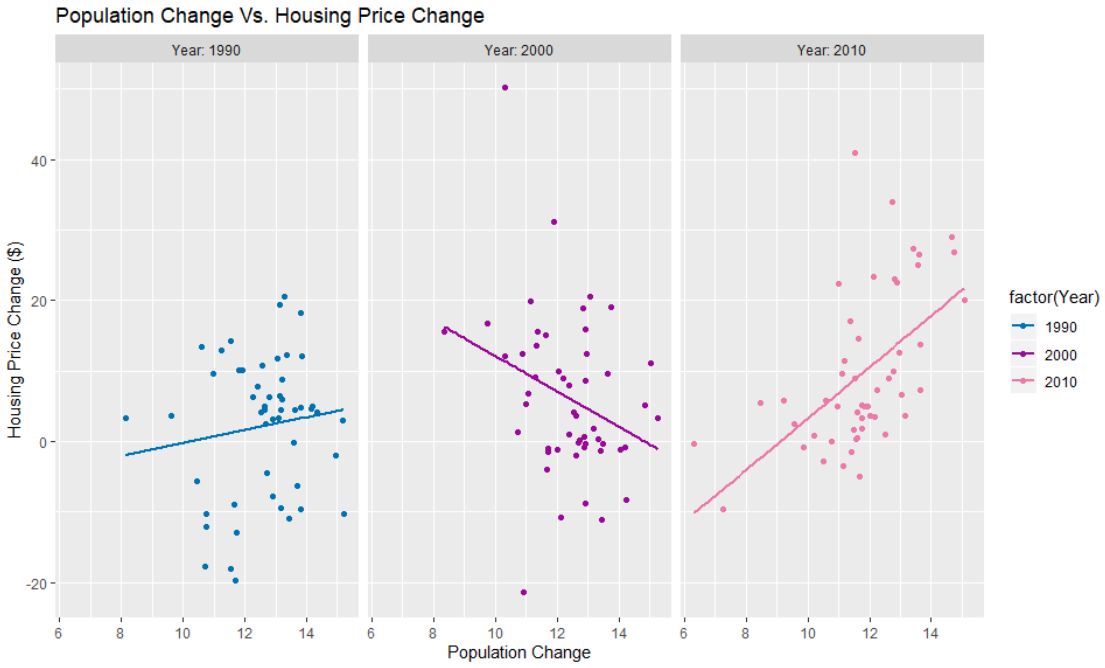


Midwest shows no change in house price. Rest all three regions show increase in “percent changes in house price”. Though as previously observed South region shows a similar trend to Midwest which slight change in “change in house prices”.

Changes in population and changes in house prices

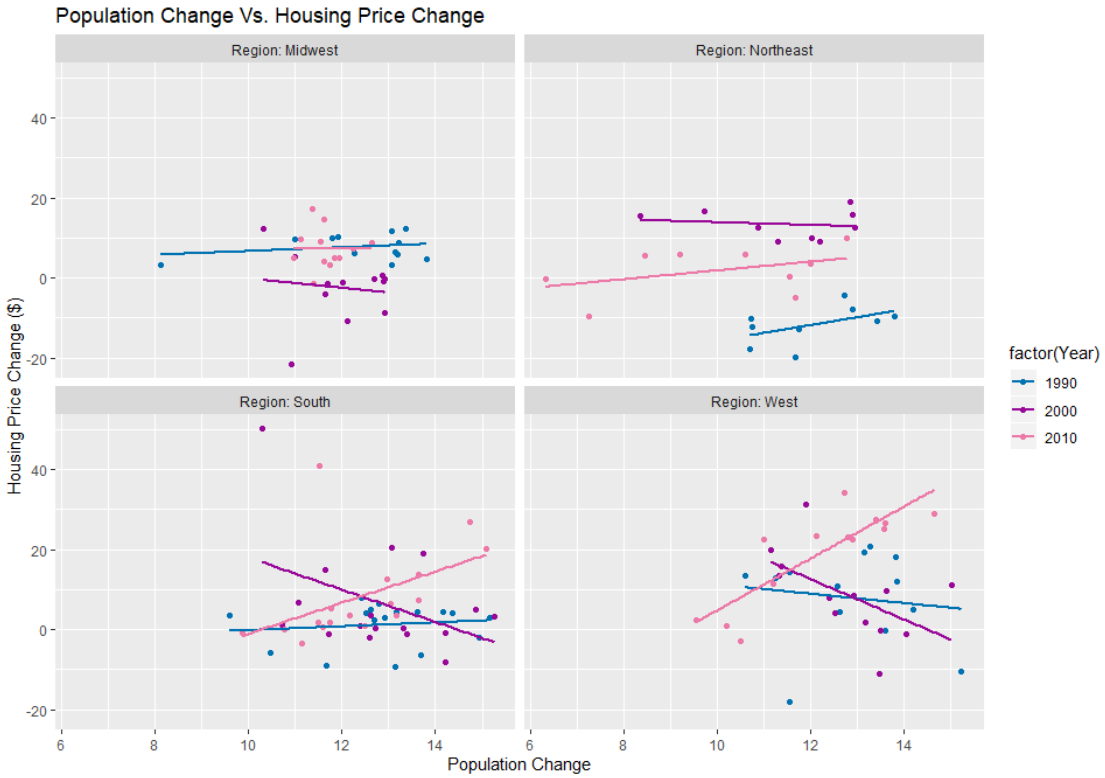
Further, we try to observe relationship between changes in population and changes in house prices. In order to establish this relationship 3 graphs are plotted over the time periods shown in the graphs below. The first graph shows period 1990 to 2000, the second one depicts 2000 to 2010 and lastly 2010 to present.

Figure 7: Population change vs House prices change



A relationship can be observed between the two parameters of changes in population and changes in house prices. In the time period between 2010 and present the graph shows a positive trend which indicates a directly proportional relationship between the two aforementioned variables. In the time period of 2000-2010 there is a decrease in house price with respect to increase in change in population. There is a slight increase in change in house prices with respect to population change.

Figure 7: Population change vs House prices change (Region Wise)



The region wise graphs compel us to introspect on the various trends between changes in population and changes in house prices. Starting with the year 2018 the graph shows an upward trend for all the four regions i.e. with increase in population change there is an increase in change in house prices. In the year range 2010s the population change is in inverse proportion with change in house prices. In 1990s there are no interpretable trends.

Conclusion

The graph for house prices shows that there is an increasing trend for the house prices over the year. It is also a known fact that the population of various states has grown over the year. Keeping the above constraints in mind it is expected to observe a positive linear relationship between the changes in the population over the year with respect to the changes in house prices. The house prices here are adjusted to the CPI because we need to take inflation into account while dealing with the time series analysis of any financial data. Hence, on observing the data and knowing the logical trends and the graphs observed from the data plotted above, the natural conclusion that Changes in house prices with respect to change in Population shows a positive relationship can be derived.