# 5.3 Introductory Course Capstone Project

## First Statistical Short Report

This short report will be based off of what has been found after cleaning and graphing the data. This report will not contain any insights gained from machine learning models, just what I can find through looking at the graphs of the data. This will also be a general report with observations regarding the data as a whole, trends spotted throughout the data and some individual exceptions to general trends. More specific observations regarding each individual city will be included in a different report.

I created two series of graphs to examine the data I had collected. Both series of graphs were created from different datasets. The first series is based on the median value of homes in the examined cities over time. The second series of graphs is the median market rent rate over a period of time for the examined cities. Both datasets were acquired from Zillow(https://www.zillow.com/research/data/). From here I compared the graphs side by side.

Looking across the graphs some general observations can be made. The data for the home values starts much earlier then the data for median rent value. The home value has observations going back to 1998 while the rent data varies from city to city but none of the rental data goes back further then 2010. This presents some complications because the financial crisis of 2008 starts two years before my rental data. However, the financial crisis created a downturn in home values that lasted for years in the real estate market so for some cities I can still examine what the relationship between rent and home prices was during a portion of the downturn.

All graphs were constructed using a time series scatterplot and each graph contains information for only one city. This information is far more obvious in the rent value graphs

then the home value graphs. The frequency and smoothness of observations in some of the home value charts is so high that the dots for the observations overlap enough to create an almost solid line to the casual observer. The dots on the rent charts are far less frequent and often individual dots move a noticeable distance vertically on the chart from one dot to the next. For the rental charts I added a "smoothed" line with a confidence interval to aid in interpretation.

For the rental graphs almost all of the rent prices increase over the time period. The one possible exception is Philadelphia and that is only if you look at the smoothed line and not the dots signifying the individual observations. Philadelphia is also one of the more chaotic charts with a several sharp increases and decreases in the observations throughout the graph. For the rental graphs where the data goes back to 2010 there is generally either a slight decrease or little change to rent prices until 2012. The one exception to this category (data going to 2010) is Washington, D.C. which generally increases throughout the entirety of the time period.

Home values increased over time across all cities if we look at the graphs from beginning to end (1997-2018). All of them have some level of increase over time until approximately 2008, a decrease in home values and then prices stabilize and begin to increase. This turn usually happens near 2012. When making observations about this data it is very difficult to give specific dates due to the changes in the real estate markets of these cities happening at slightly different times despite their apparent similarities. The majority of these cities also have their peak in housing prices in 2018, the most recent year of the data. For the cities that do not fit into this category it is because their housing prices have yet to go beyond their pre-financial crisis peak.

For all of the cities there is a general trend of increases across both rent and house prices. From a visual observation these two factors appear to share a strong positive correlation. Despite this there are some cities that appear to have an increase in value of the properties that has outpaced the rate of increase in rent. Among these are Chicago, Detroit, San Francisco and Philadelphia