



Work from Where

Work from home and the real estate market



Work from home

Many companies which shifted jobs out of the office towards work-from-home have made these changes permanent.

This will likely be compounded by a longer than expected pandemic recovery

in addition, high tech companies are increasingly leaving traditional tech hubs like New York and the SF Bay Area for emerging tech markets like Austin and Denver

A more geographically fragmented tech market will naturally promote remote work as companies try to recruit talent nation-wide

The Changing Housing Market

As work from home becomes the new normal, new housing markets become options for high tech workers

Due to continuing economic uncertainty, it's likely that these changes have not yet been priced in, especially in less dense markets

Essentially, I looked at states with good internet connectivity, good quality of life and very low home prices

Defining Good Internet

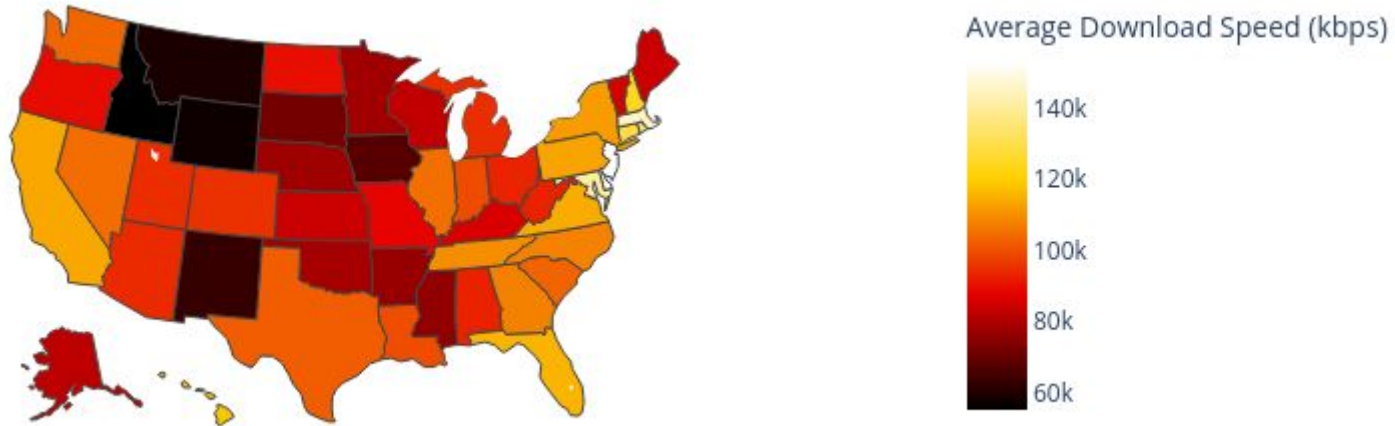
I used speed test data from Ookla. The makers of Speedtest.net

Speedtest.net is the world's largest internet connectivity benchmarking service

They offer three types of data: Upload Speed, Download Speed, and Latency

Very granular-I grouped the data by state and county

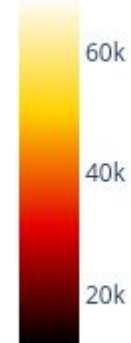
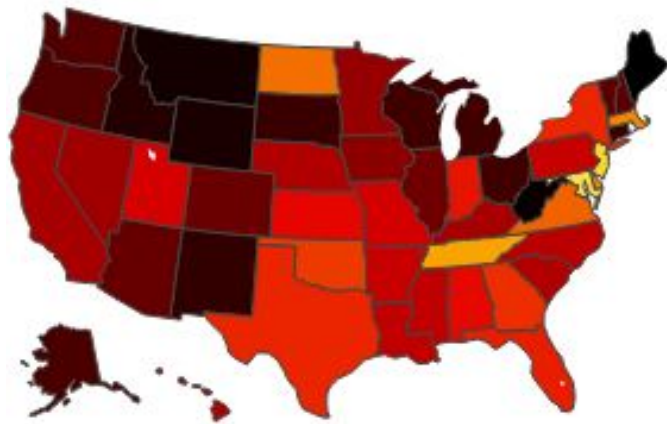
US States, download speeds



US States Download Speed

The Top 10 States for download speed were: Florida, Hawaii, New Hampshire, Connecticut, Rhode Island, Maryland, District of Columbia, Massachusetts, Delaware, New Jersey

US States Upload Speed



US Upload Speed

Top Ten States for Upload Speed: Oklahoma, Virginia, North Dakota, Massachusetts, Delaware, Tennessee, New Jersey, Maryland, District of Columbia, Rhode Island

US Combined Speed

Six States were present on both lists:

Rhode Island, Maryland, District of Columbia, Massachusetts, Delaware, New Jersey

Consumer internet is often **asynchronous**: it offers much higher download speeds than upload

For web browsing, streaming video and other common residential

Asynchronous Internet

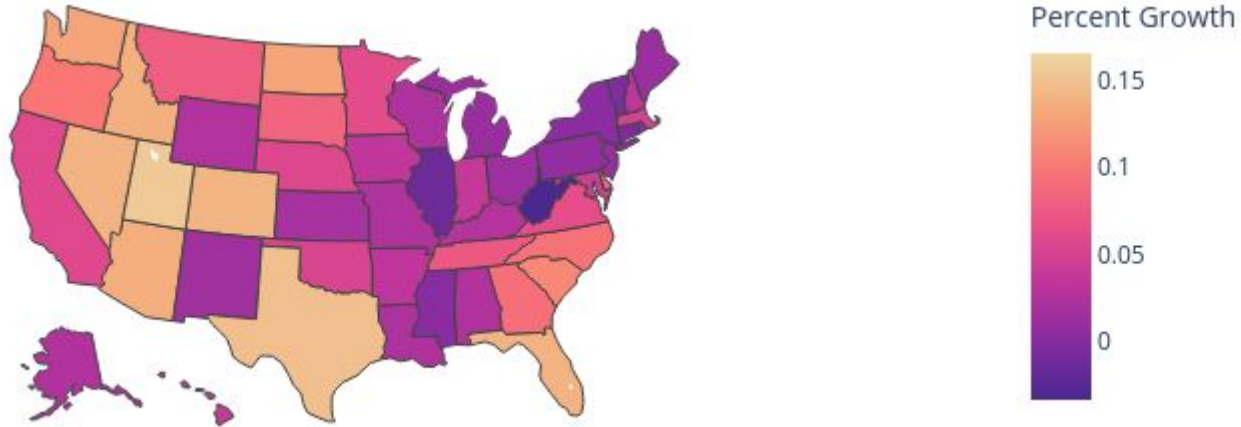
For web browsing, streaming video and other household purposes, it's normal to download much more data than you upload

For this reason consumer internet service is often Asynchronous: it offers much higher download than upload speeds

In contrast, work tasks like video conferencing, torrenting, FTP etc require relatively more upload data.

Since asynchronous internet plans offer faster download, I decided to focus on upload speed as the most likely bottleneck for data

Population Growth



Top Ten Population Growth

The ten states with the highest percent change in population over the period 2010 - 2019 were: Washington, North Dakota, Arizona, Idaho, Florida, Nevada, Colorado, Texas, Utah, District of Columbia



Part 2: North Dakota

North Dakota

The state of North Dakota has ranked highly on several of these lists. It has among the highest upload speeds, nearly 14% population growth, but among the lowest home prices

Mapping North Dakota

In order to make better use of my granular internet connectivity data, I used **Folium** to create several overlays to an openstreetmaps map tileset

I used **Shapefiles** from the US Census Department and Ookla to correlate geographic data in a Geodataframe

Modeling

I ran a SARIMA(2,1,2)x(1,1,1,12) model on monthly North Dakota Single Family home data from 2009-2019

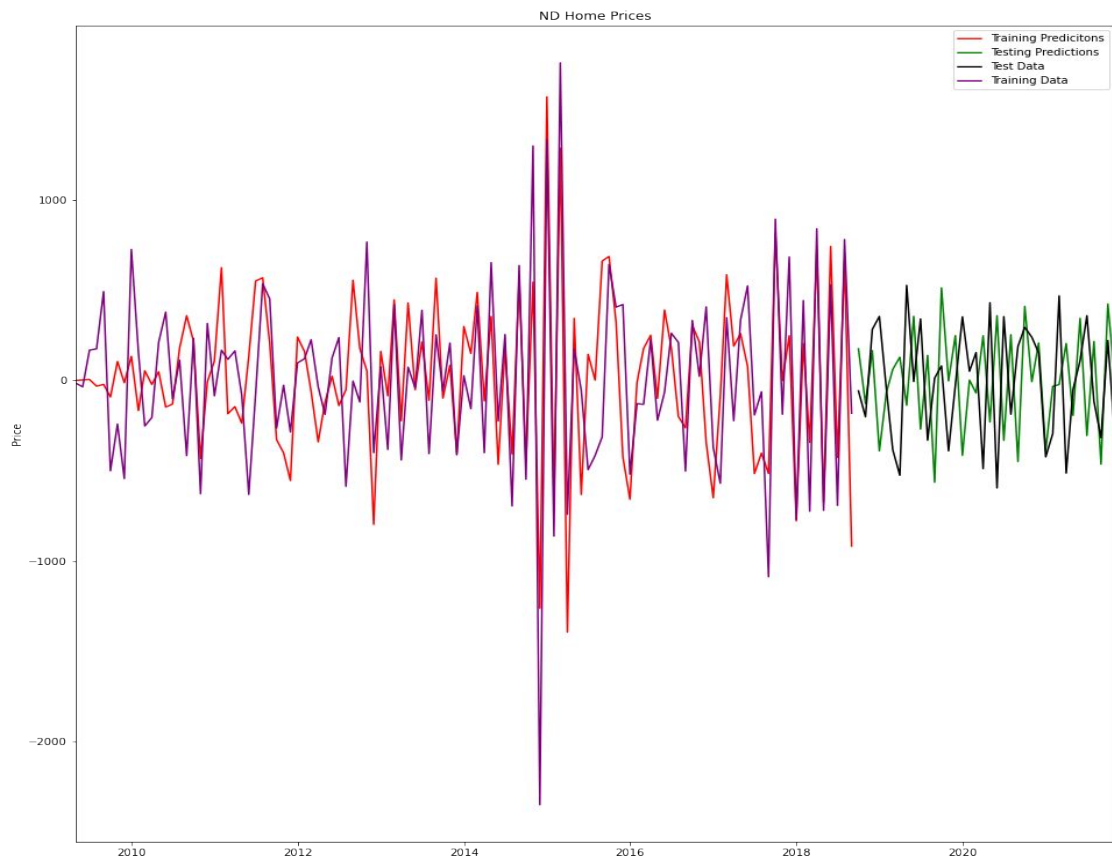
I had to difference the data 3 times to achieve stationarity

Because there was yearly seasonality, I used the

Folium

Folium is a python wrapper for the leaflet.js mapping library

It makes creating responsive cartographic webapps a breeze



Results

On the validation set, I was able to get a mse of 222,480

While this does a good job accounting for seasonal variation, it's less useful for guiding actual buying decisions because I'm attempting to predict a new phenomenon

Conclusions

North Dakota stands out as a great value for people who want to work from home

Sources

Zillow Home Value Index (Single Family Residence): State and county data

Ookla Speedtest Data Q1 2020

US Census

<https://www.census.gov/cgi-bin/geo/shapefiles> Shapefiles for state, county and metropolitan data