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IST 718: Lab 2

Introduction

Investors are always trying to find the next big opportunity, especially with respect to real estate. A group of Arkansas-based investors is seeking a stable, high-yield area of the country to invest in single family properties. They are interested in keeping their investment local if the conditions are favorable but are willing to invest elsewhere. To support their decision, they have sponsored this study to determine the best three zip codes nation-wide to invest in.

About the Data

The data for this study is sourced from Zillow.com's historical single-family median home value data (https://files.zillowstatic.com/research/public/Zip/Zip_Zhvi_SingleFamilyResidence.csv). The data consists of the following attributes:

Attribute	Description
RegionID	Unique ID
RegionName	Region's zip code
City	Region's city
State	Region's state
Metro	Region's major metro area affiliation
CountyName	Region's County
SizeRank	Region's national size rank
Monthly Median Home Value (time series)	Region's monthly median home value

In order to simplify code and improve legibility, the following fields were removed from the data: RegionID, CountyName, and SizeRank. Additionally, RegionName was renamed to zipcode for clarification. The data for the year 1996 was only for part of the year, so this time series data was also removed. To improve future modeling, all zip codes with incomplete data were removed.

Preliminary Analysis

The investors at particular interest in 4 major metro areas in Arkansas (Hot Springs, Little Rock, Fayetteville, and Searcy), so the historical median home prices were investigated for each area. The time series plot for these regions can be seen below (Figure 1). From this initial analysis, it appears that there has been fairly steady growth over the last two decades with declines aligning with the 2008 financial crisis. Of the 4 metro areas, Searcy seems to have been the least impacted by the crisis, however, homes in that area are at a much lower price-point than the others. Fayetteville seems to be the most promising from an investment standpoint as it has had consistent growth since 2012 at a higher rate than the other Arkansas metro areas. If the investors wish to keep their investment local, perhaps a mixture of homes purchased in the Fayetteville and Little Rock metro areas would represent the safest investment strategy.

Figure 1: AR Metro Area Average Median Home Values 1997-2018
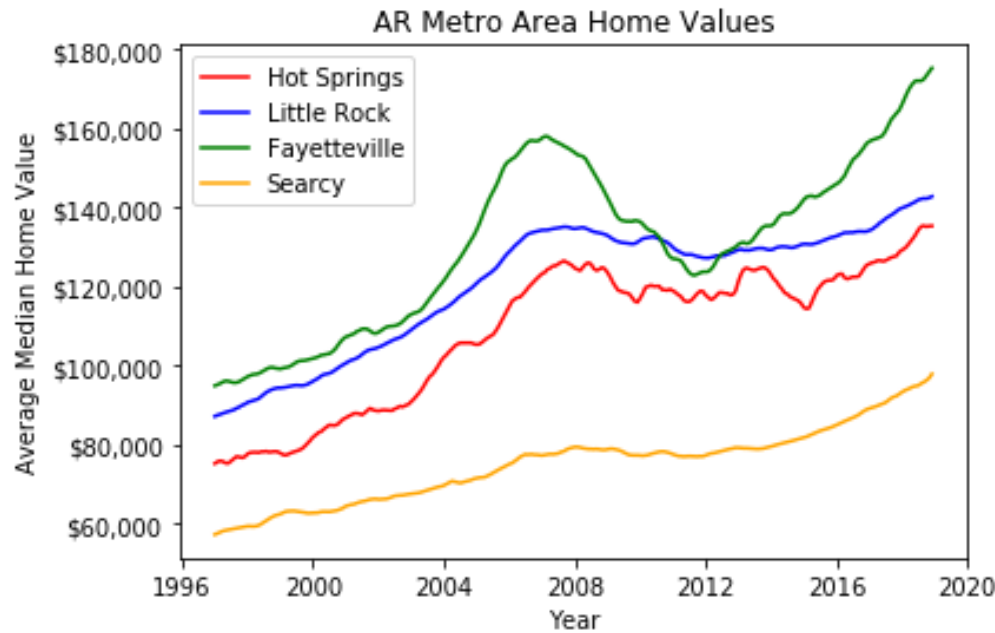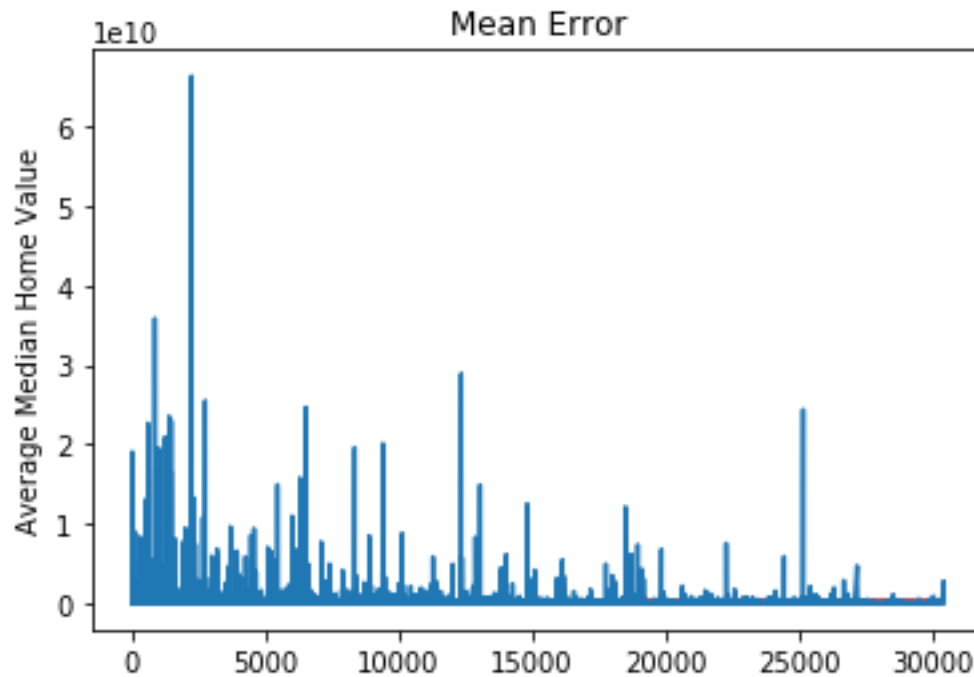

Prediction Model

In order to explore the potential options for investing outside of Arkansas, a prediction model for median home values was developed. For informing this model, 1997-2017 time series data was used as the training dataset while 2018 was used to test the prediction model. The model itself is an ARIMA (Auto-Regressive Integrated Moving Average) model which consumed the past 6 months of data to make its prediction about the next month's median home value. The model had a relatively good fit to the actual data when predicting 2018 values as can be seen in Figure 2.

Figure 2: Predicted (red) vs Actual (blue) Median Home Values 2018
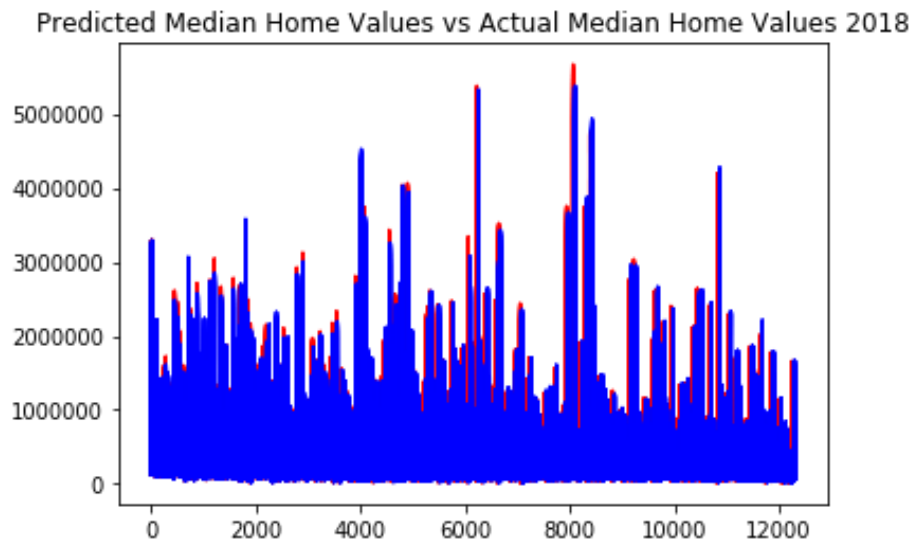
However, the mean error of the model shows that there are predictions that were incorrect (see Figure 3). This is likely due to unpredictable shocks in certain areas' housing markets.

Figure 3: Mean Error of Median Home Value Prediction Model

The 10 highest growing zip codes based on the original prediction model are shown below. As stated previously, there were unexpected shocks (negative growth) in many of the top predictions, all of which are in California. It is likely that this is a result of the widespread wildfires that destroyed many homes.

zipcode	City	State	2017-12ActValue	2018-12ActValue	ActGrowth%	2018-12PredValue	PredGrowth%	GrowthDiff%
15358	Centerville	PA	49117	60315.1	22.8	61733.1	25.7	2.9
15078	Smith Township	PA	78278	93902.8	20	95958.4	22.6	2.6
94085	Sunnyvale	CA	1390772	1.30382e+06	-6.3	1.66143e+06	19.5	25.8
94043	Mountain View	CA	1807989	1.75585e+06	-2.9	2.15248e+06	19.1	22
94086	Sunnyvale	CA	1779860	1.72973e+06	-2.8	2.0739e+06	16.5	19.3
94087	Sunnyvale	CA	2123832	2.06783e+06	-2.6	2.46341e+06	16	18.6
95050	Santa Clara	CA	1322318	1.24694e+06	-5.7	1.50711e+06	14	19.7
95130	San Jose	CA	1515209	1.4994e+06	-1	1.72556e+06	13.9	14.9
94066	San Bruno	CA	1186670	1.12003e+06	-5.6	1.3479e+06	13.6	19.2
94063	Redwood City	CA	1225371	1.14193e+06	-6.8	1.38768e+06	13.2	20

In order to offset incorrect predictions in the model results, an adjusted growth score was calculated using the following calculation:

$$Adjusted\ Growth\ Score = \frac{Predicted\ Growth\ \%}{1 + Predicted\ Growth\ \% - 5 * Growth\ Difference}$$

Using this new value, the top 10 recommended zip codes to invest in per the model are as follows:

zipcode	City	State	2017-12ActValue	2018-12ActValue	ActGrowth%	2018-12PredValue	PredGrowth%	GrowthDiff%	AdjGrowthScore
15358	Centerville	PA	49117	60315.1	22.8	61733.1	25.7	2.9	36.9
15078	Smith Township	PA	78278	93902.8	20	95958.4	22.6	2.6	32.2
8317	Weymouth Township	NJ	174181	193995	11.4	195598	12.3	0.9	20.1
63111	Saint Louis	MO	61344	67938	10.7	68681	12	1.3	17.5
16617	Bellwood	PA	117134	128684	9.9	129690	10.7	0.8	17.4
72342	Helena - West Helena	AR	32657	35282.9	8	35363.9	8.3	0.3	15.1
13675	La Fargeville	NY	91322	99319.2	8.8	98947.5	8.4	0.4	14.8
7979	Tewksbury Township	NJ	542233	596789	10.1	607514	12	1.9	14.5
41085	Silver Grove	KY	90482	97475.5	7.7	97121.5	7.3	0.4	12.6
36105	Montgomery	AL	25310	27073.9	7	27236	7.6	0.6	12.2

Although the top 2 predictions have a relatively high growth score, they may be risky investment opportunities since they have experienced such extreme growth in just a year's time. The safest 3 investment options would more likely be: 08317 Wymouth Township, NJ; 63111 St. Louis, MO; and 16617 Bellwood, PA. A map of the adjusted growth scores aggregated by state average can be seen in Figure 4 (below).

Figure 4: Average Adjusted Growth Score by State

Average Adjusted Growth Score by State, Dec 2017 vs Dec 2018
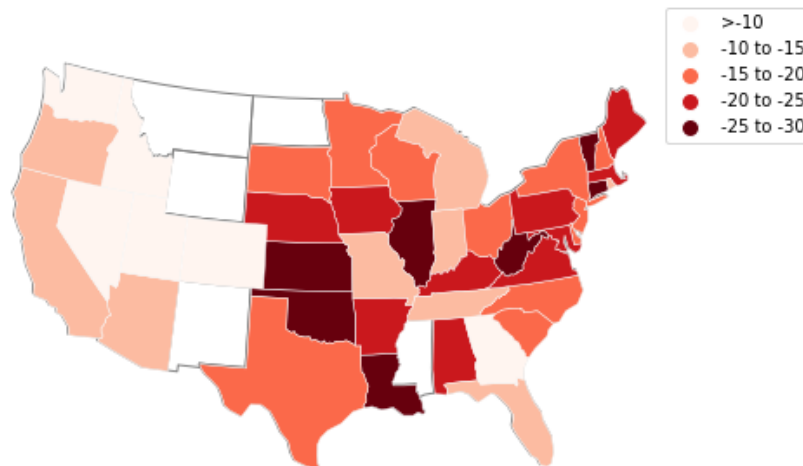
Conclusions
A group of Arkansas-based investors is seeking insight on the best single-family property investment opportunity. If they wish to invest within Arkansas, a portfolio consisting of properties within the Fayetteville and Little Rock metro areas would offer the best return. However, if they wish to open their investment to the entire country, a portfolio of homes within Wymouth Township, NJ, St.Louis, MO, and Bellwood, PA would be best.