



TIME SERIES MODELING FOR REAL ESTATE INVESTMENT

PRESENTED BY
GROUP NARUTO

NARUTO

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AGENDA

1. OVERVIEW
2. PROBLEM STATEMENT
3. OBJECTIVES
4. METRIC OF SUCCESS
5. EDA
6. MODELING
7. CONCLUSION
8. RECOMMENDATIONS
9. DEPLOYMENT

OVERVIEW

- The real estate industry in the USA is a significant contributor to the country's economy, accounting for approximately 6% of the Gross Domestic Product (GDP).
- This industry comprises of various sub-sectors, including residential and commercial real estate, real estate development, property management, and real estate investment trusts (REITs).



PROBLEM STATEMENT



- A number of factors drive the real estate market including demographics of the potential buyers, affordability, disparity in housing access and location as well as the current economic climate.
- The many variables can make the process tedious for the buyers.

MAIN OBJECTIVE



- To develop a time series model that would predict the top five zipcodes to invest in

SPECIFIC OBJECTIVES

A thin orange line starts at the top right corner of the slide, slopes down towards the center, and then turns horizontally to the left.

- To act as a consultant for Naruto investment firm and provide a solid recommendation for the top 5 best zip codes for real estate investment
 - To find change in house returns over time
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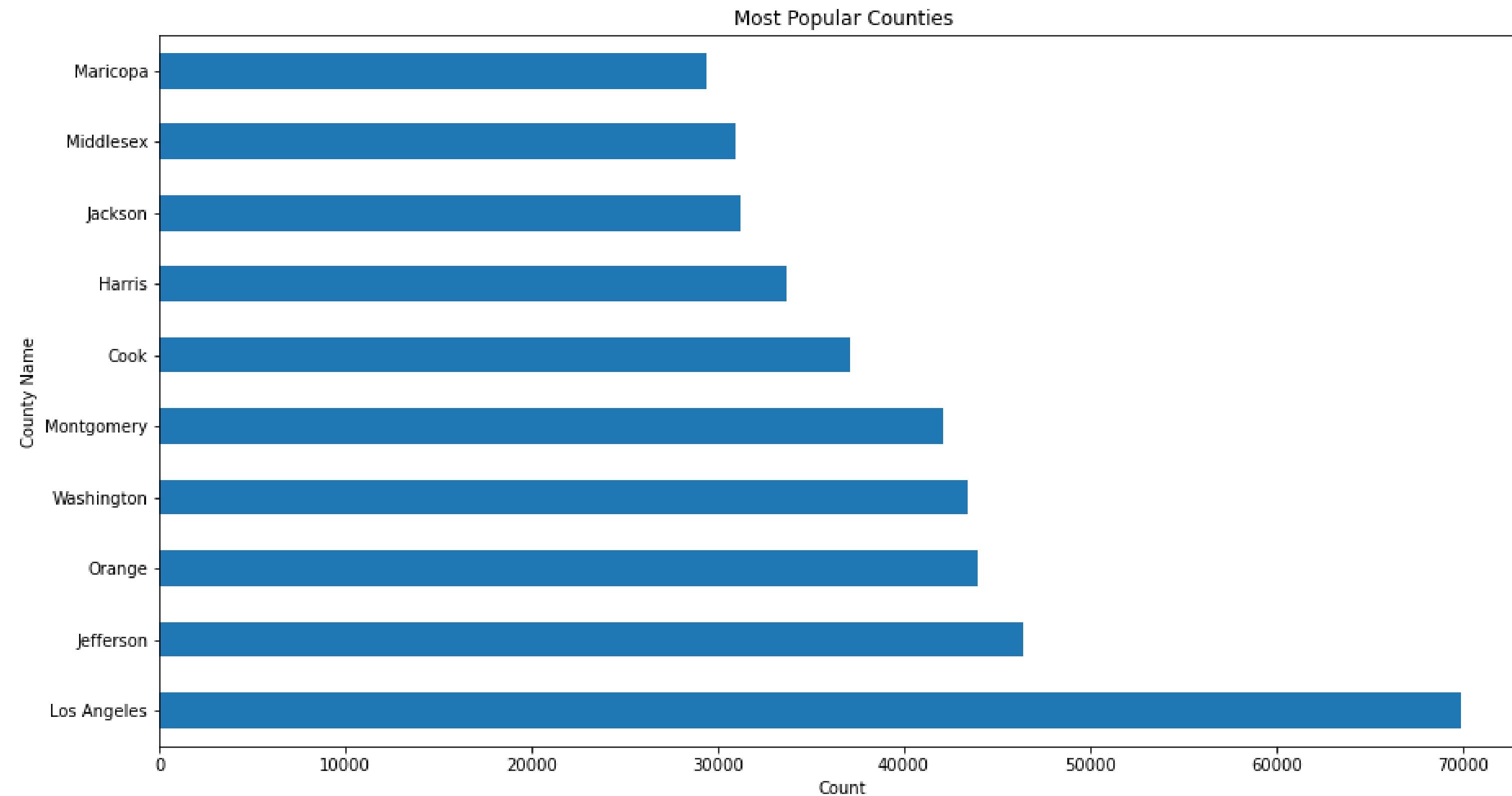
METRIC OF SUCCESS



- The model will be considered a success if it achieves a RMSE of less than 5% and the highest Return on Investment
 - Root Mean Squared Error(RMSE) provides an estimation of how well the model is able to predict the target value(Return On Investment).
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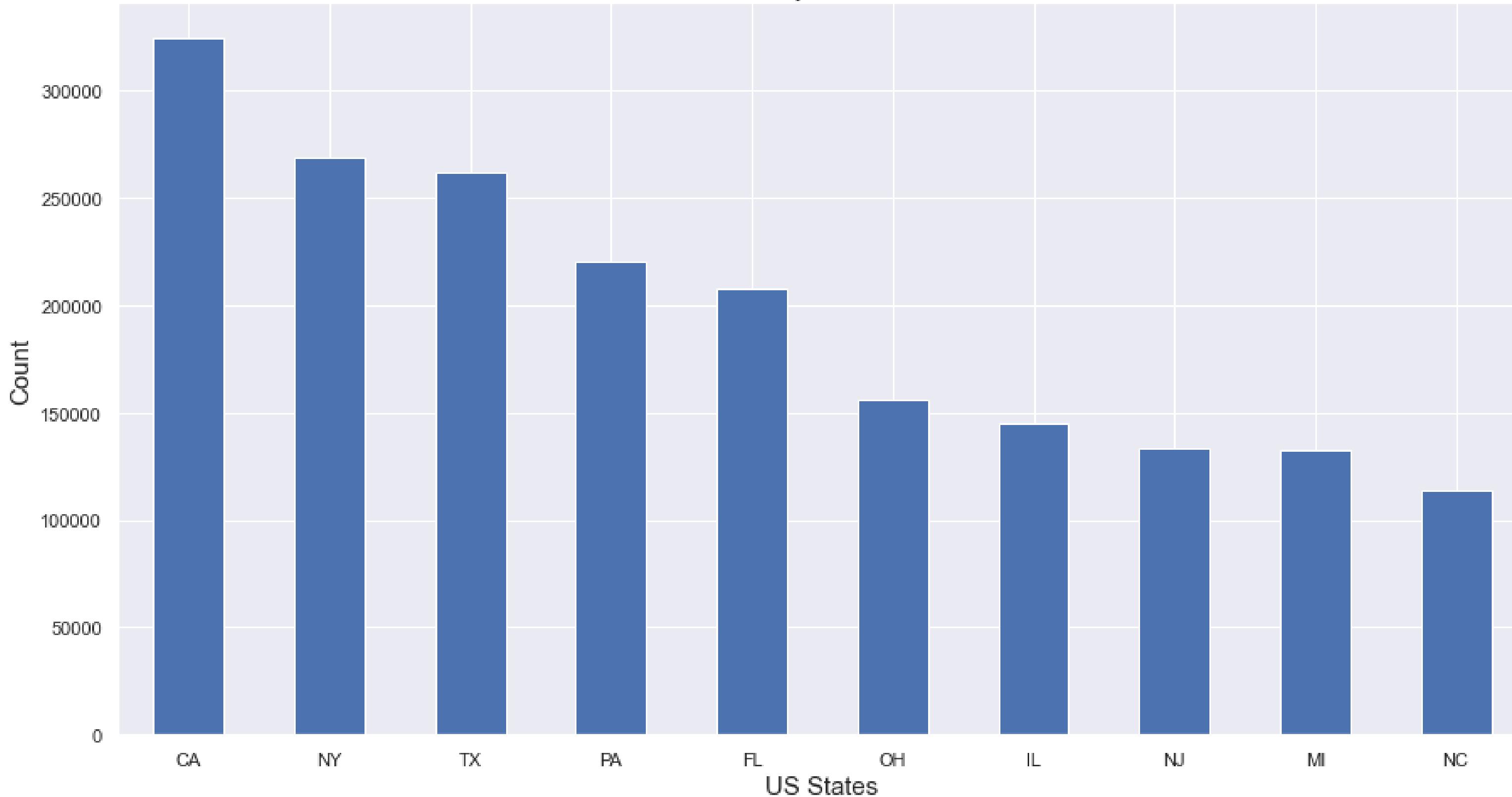
EXPLORATORY DATA ANALYSIS





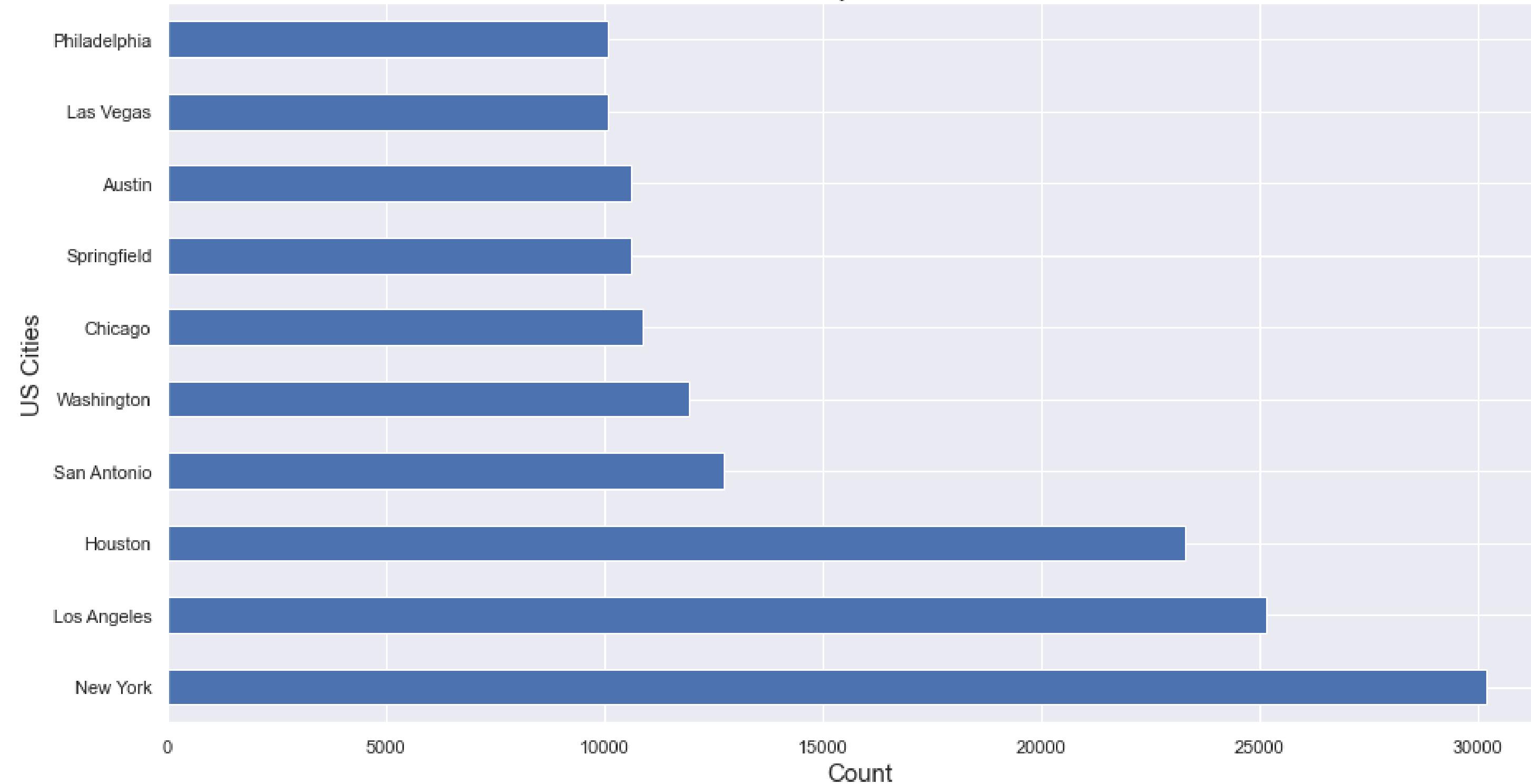
Los Angeles is the most popular County in the dataset.

Most Popular States



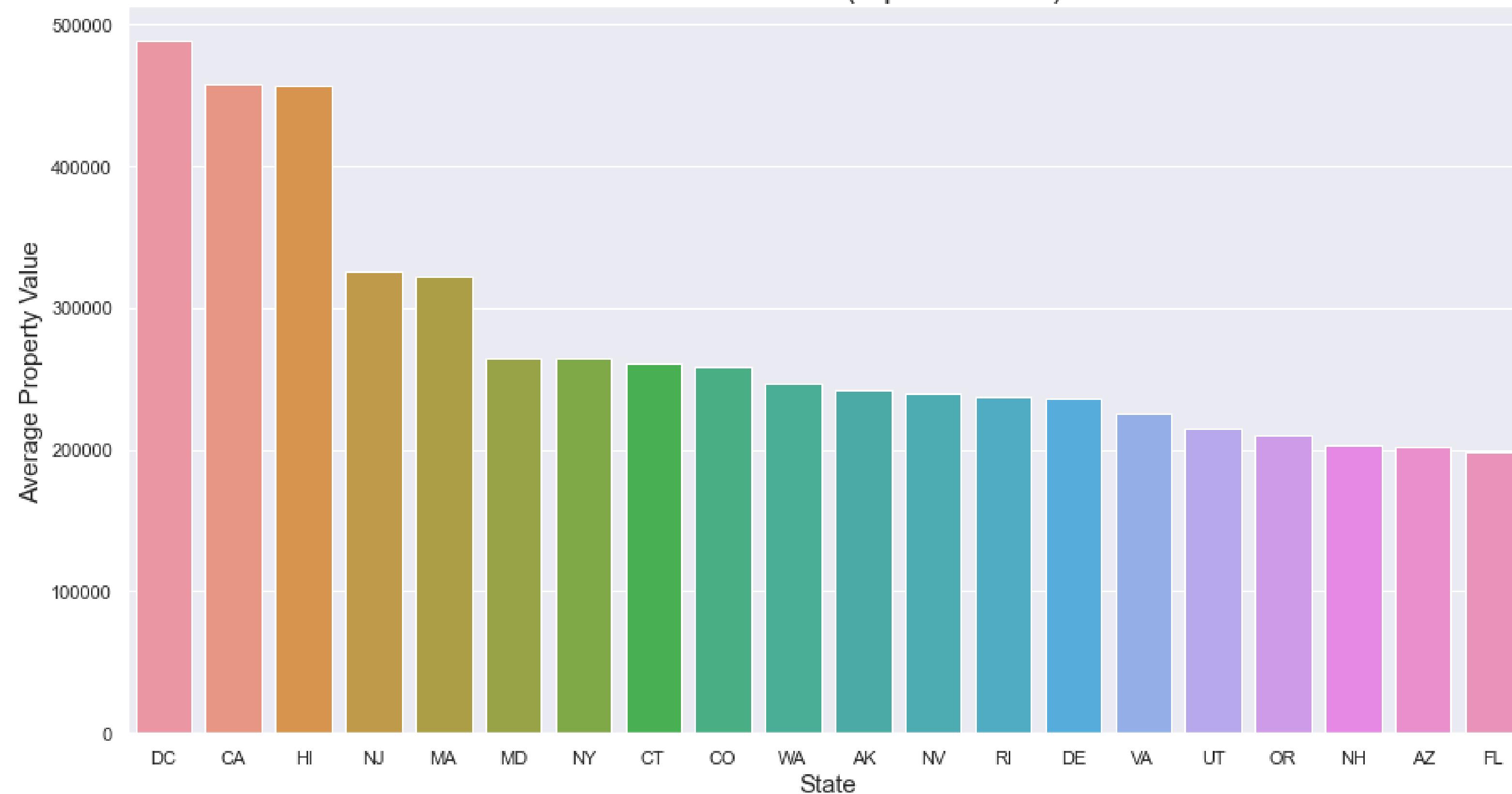
California is the most popular state.

Most Popular Cities



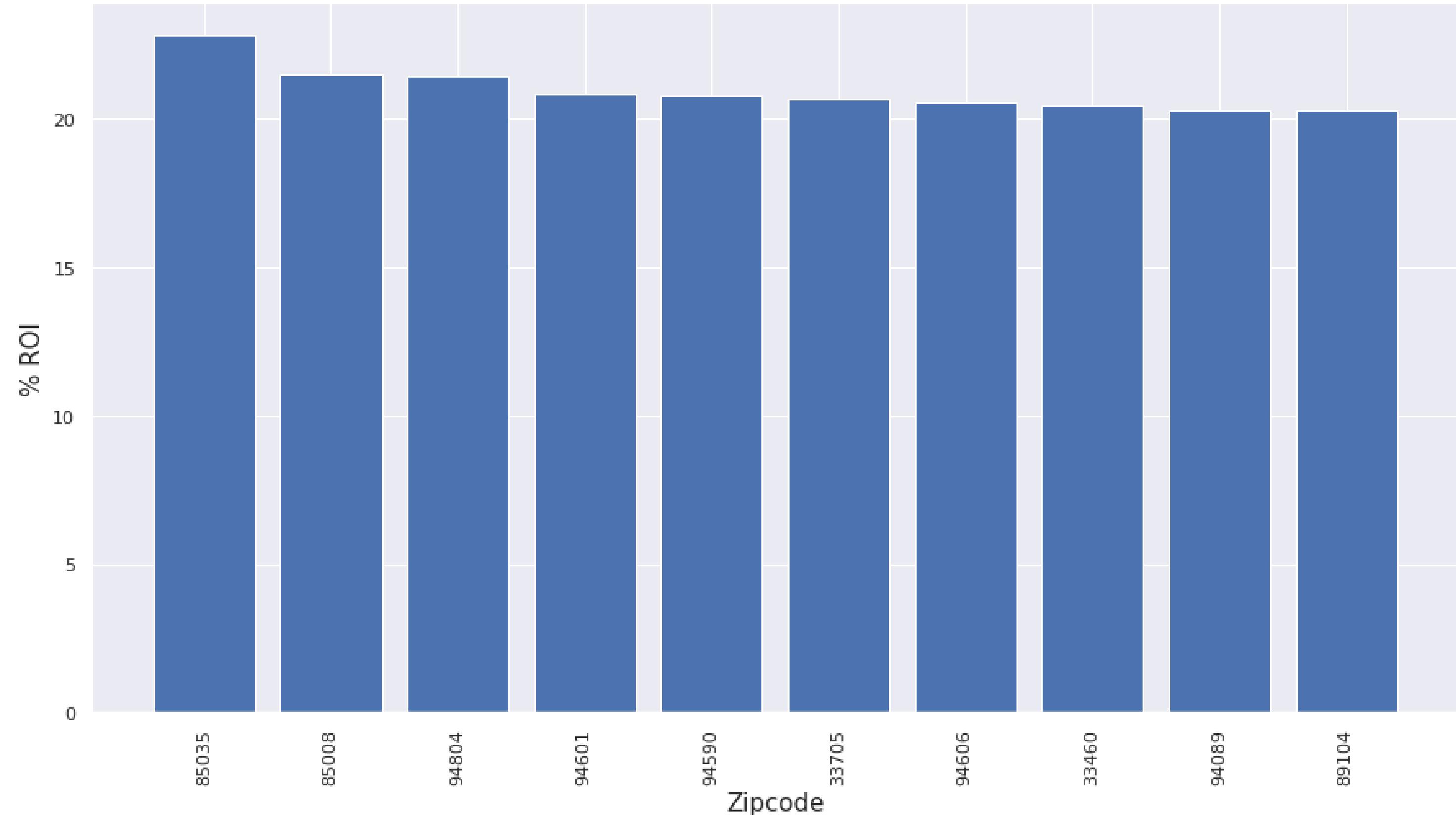
New York is the most popular city.

House Values in (top 20 States)



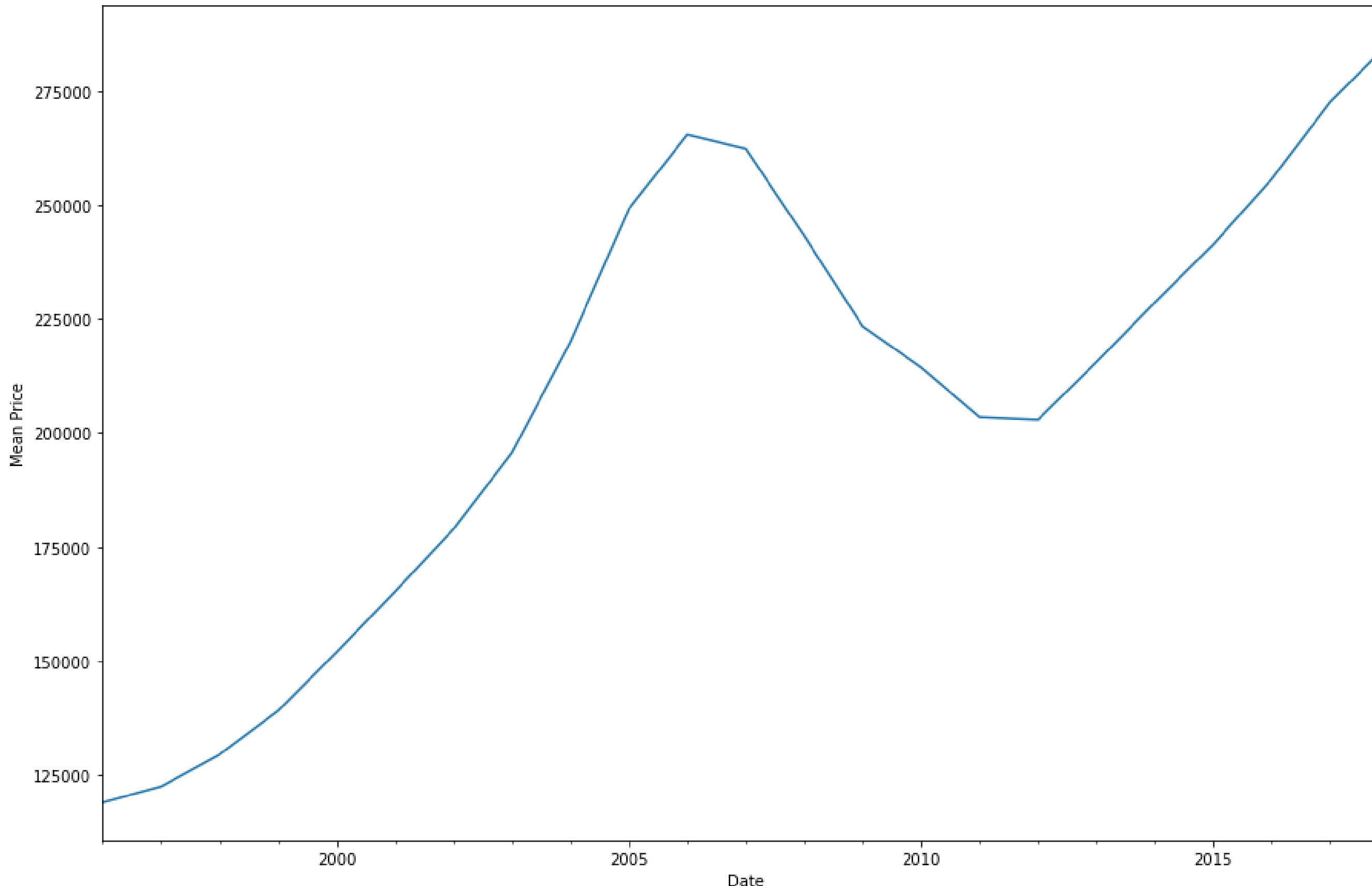
Washington DC, California and Hawaii, in that order, recorded the highest average property value

% ROI by Zipcode

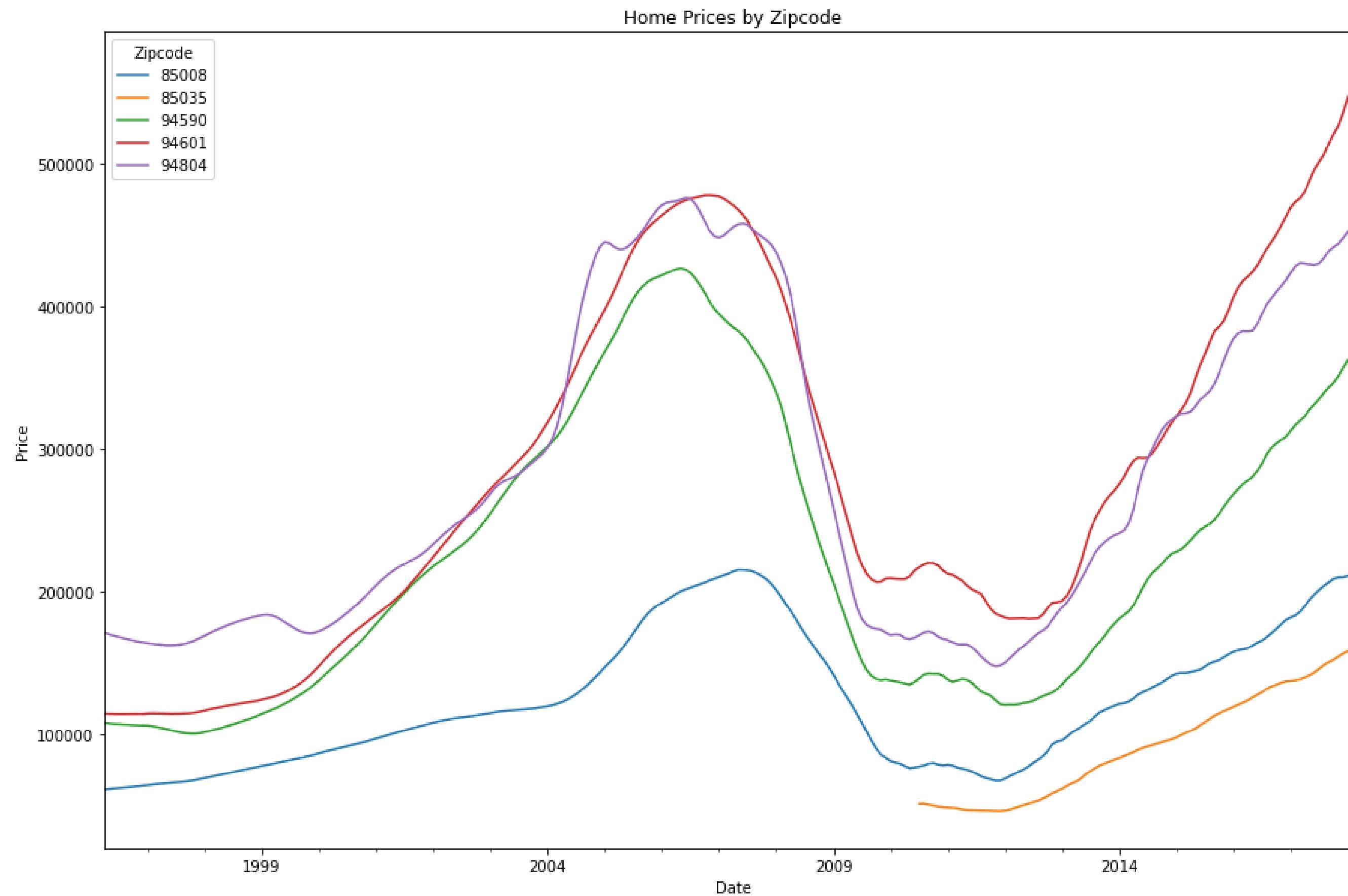


Zipcode 85035 seems to be the most profitable zipcode at 22.8% ROI from 2012 to 2018.

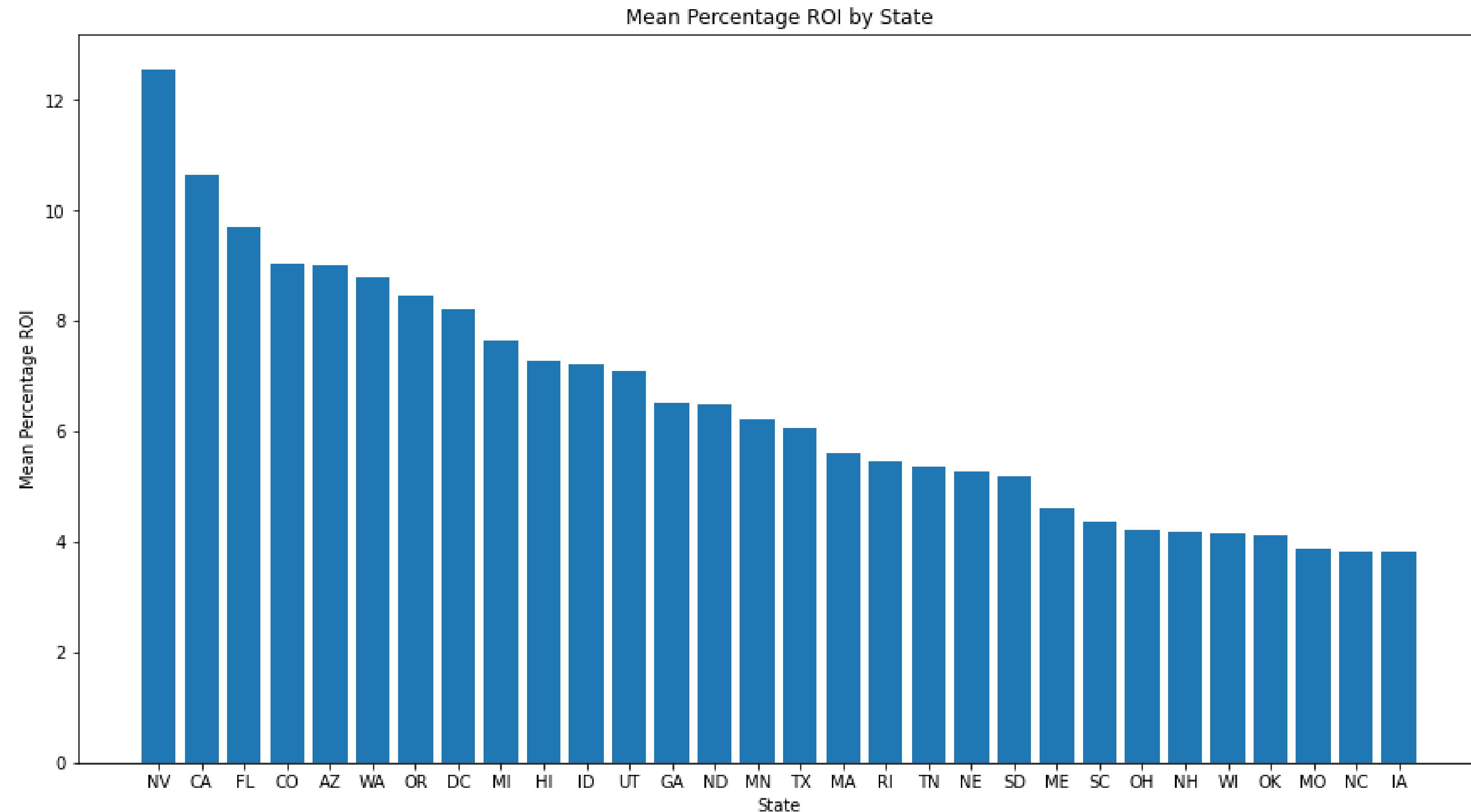
Plot of Mean House Price from 1996 to 2018 in USA



Mean House Price from 1996 to 2018 in USA



After the housing market crash in 2008 prices have been trending upwards



Nevada has the highest mean percentage return on investment

MODELLING

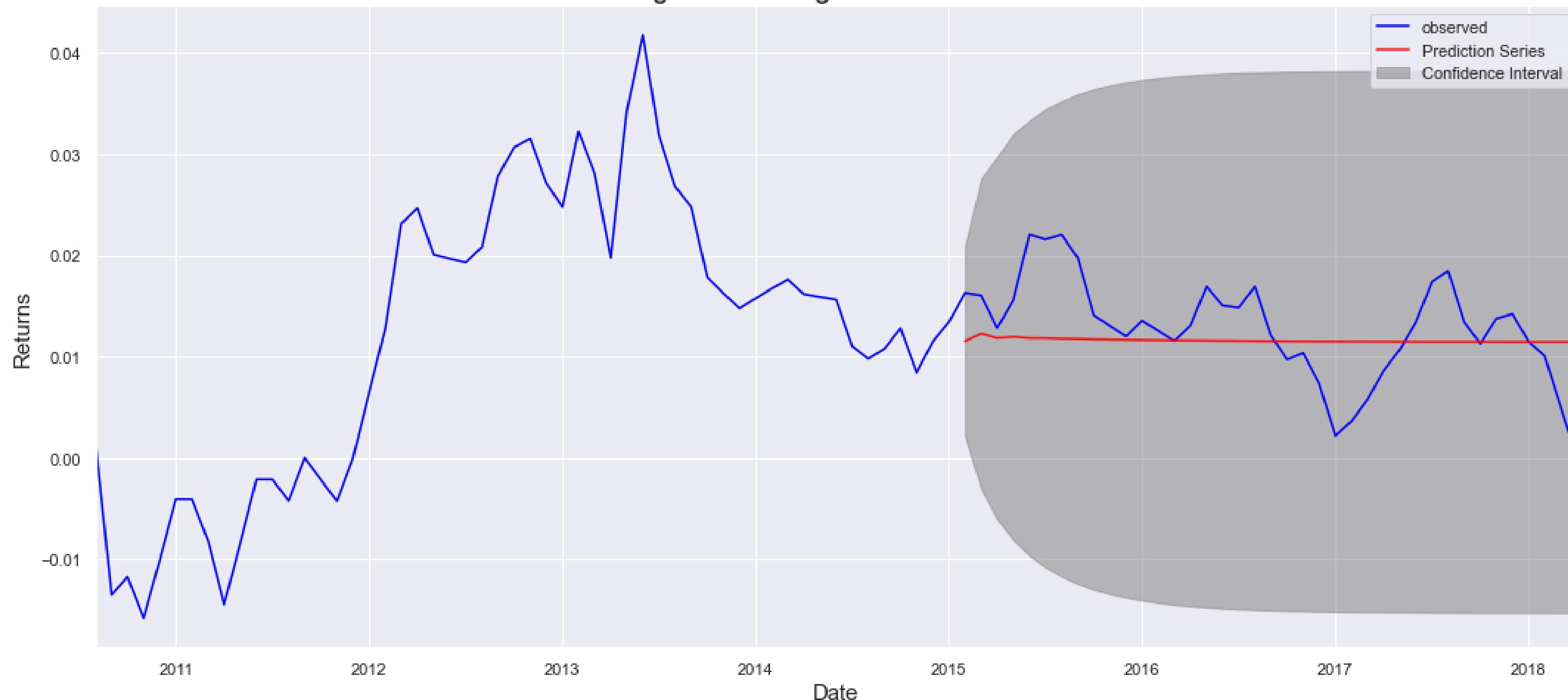


SARIMAX Results

Dep. Variable:	ret	No. Observations:	54			
Model:	ARIMA(2, 0, 1)	Log Likelihood	210.348			
Date:	Thu, 16 Mar 2023	AIC	-410.696			
Time:	20:32:05	BIC	-400.751			
Sample:	08-01-2010 - 01-01-2015	HQIC	-406.860			
Covariance Type:	opg					
	coef	std err	z	P> z	[0.025	0.975]
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const	0.0115	0.008	1.456	0.145	-0.004	0.027
ar.L1	0.4476	0.245	1.827	0.068	-0.033	0.928
ar.L2	0.4027	0.242	1.661	0.097	-0.072	0.878
ma.L1	0.8430	0.186	4.536	0.000	0.479	1.207
sigma2	2.304e-05	3.5e-06	6.572	0.000	1.62e-05	2.99e-05
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Ljung-Box (L1) (Q):	0.35	Jarque-Bera (JB):	8.82			
Prob(Q):	0.55	Prob(JB):	0.01			
Heteroskedasticity (H):	0.23	Skew:	0.12			
Prob(H) (two-sided):	0.00	Kurtosis:	4.97			
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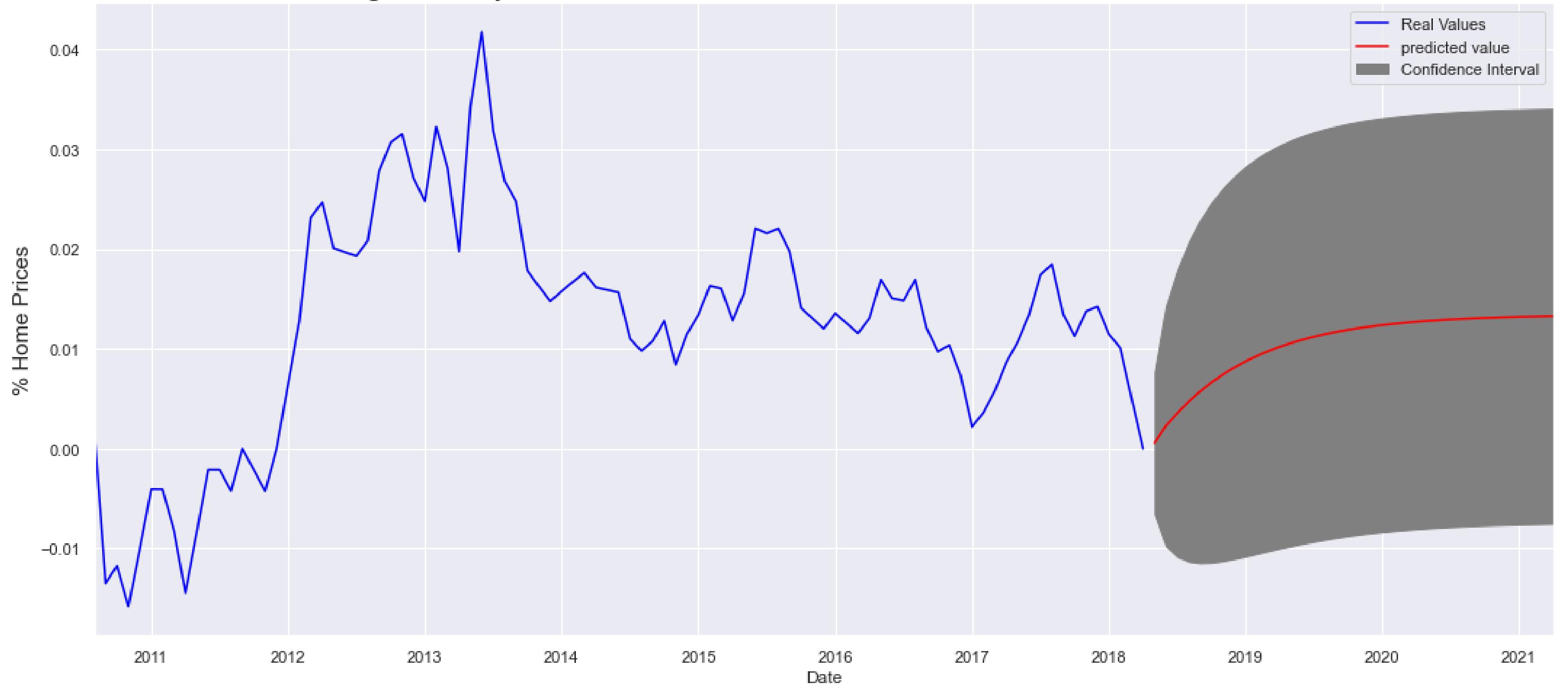
Baseline ARIMA model (order=(2, 0, 1))

Testing Forecasting Model Performance



Testing Forecasting Model Performance: RMSE 0.0050

Average Monthly Returns - 85035 - With Forecasted Values & Confidence Intervals



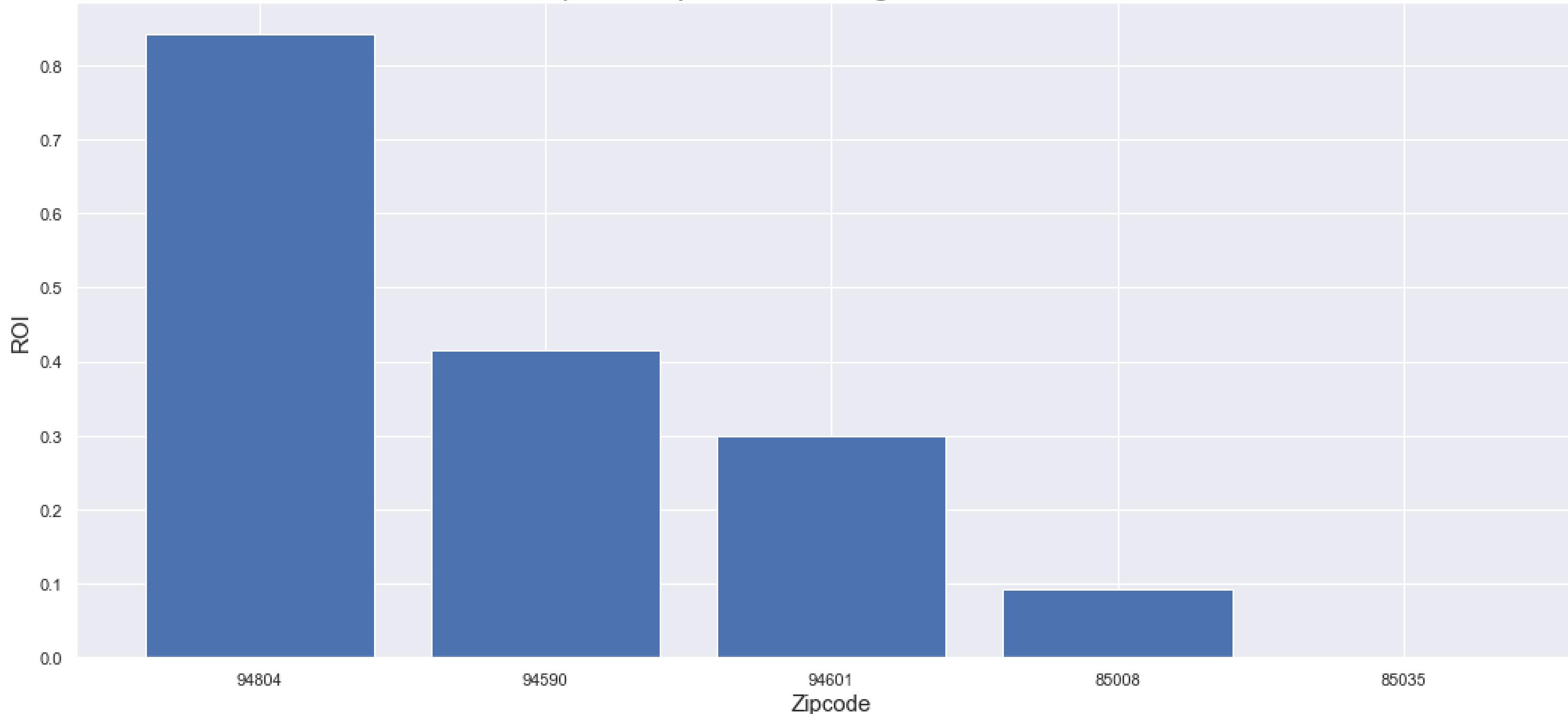
Average Monthly Returns Prediction for 85035 for 36 months (2018-2021)



CONCLUSION & RECOMMENDATIONS



Top Five Zipcodes with Highest ROI Forecast



Zip code 94804 has the highest ROI forecast so it would be beneficial to invest in this zipcode.

Zip code 94804 (Richmond, CA) can attribute its high ROI to numerous factors including, but not limited to:

- the expanding construction in the area
- the rental market has gone up 7% for the area so it's a great place to have rentals for investors who don't want to live in Richmond,
- price appreciation predicted by banking and real estate specialists

(Retrieved from - <https://www.quora.com/Is-it-worth-it-to-buy-a-house-in-Richmond-California>)

RECOMMENDATIONS

Zipcode	% ROI
94804	0.842062
94590	0.414785
94601	0.298571
85008	0.091814
85035	0.000000

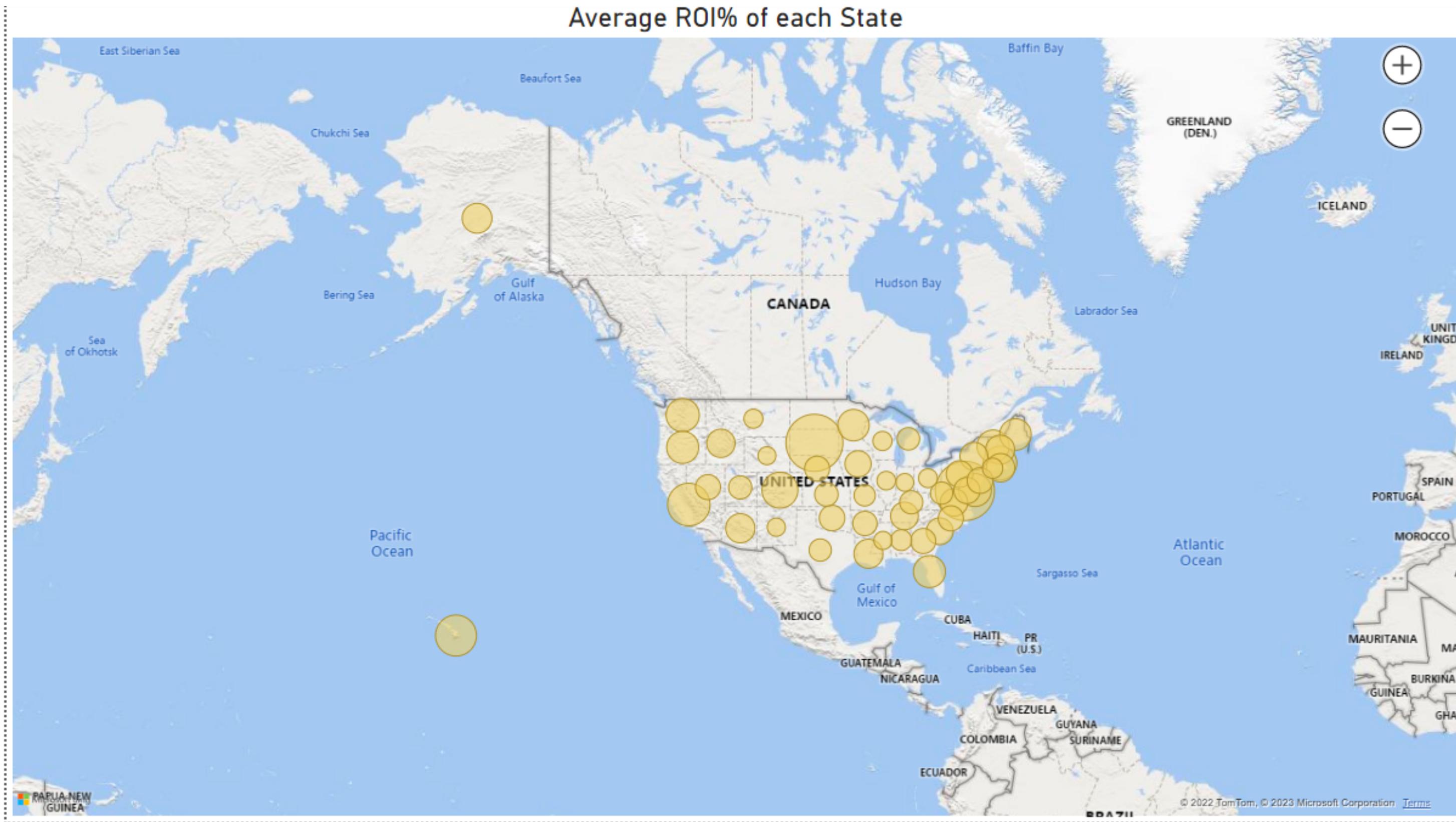
The first 4 zip codes have an encouraging predicted price seeing as they are in the positives. We would therefore recommend investing in any of the above zip codes apart from 85035 which has zero return on investment.

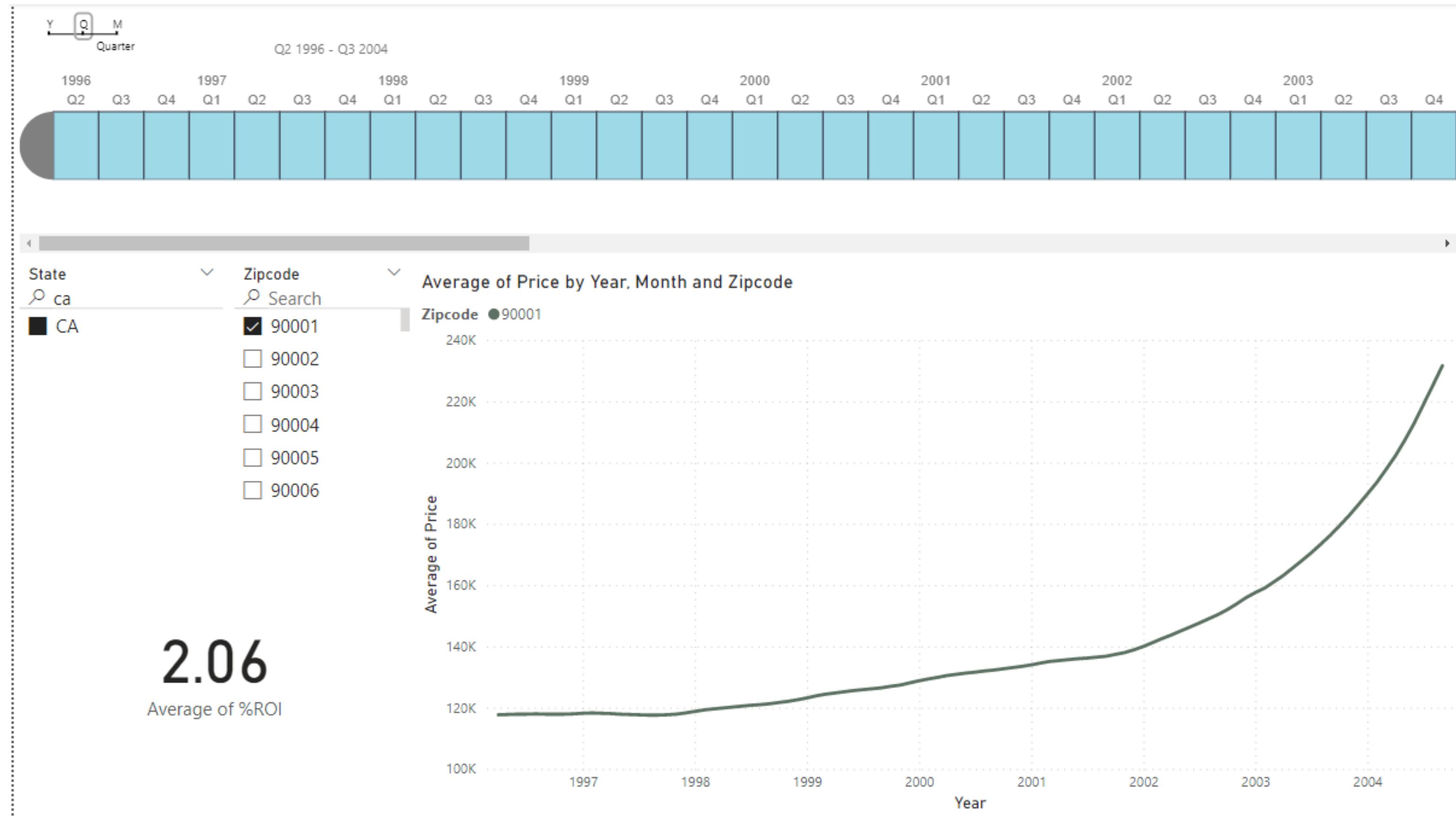
FOLLOW-UP QUESTIONS

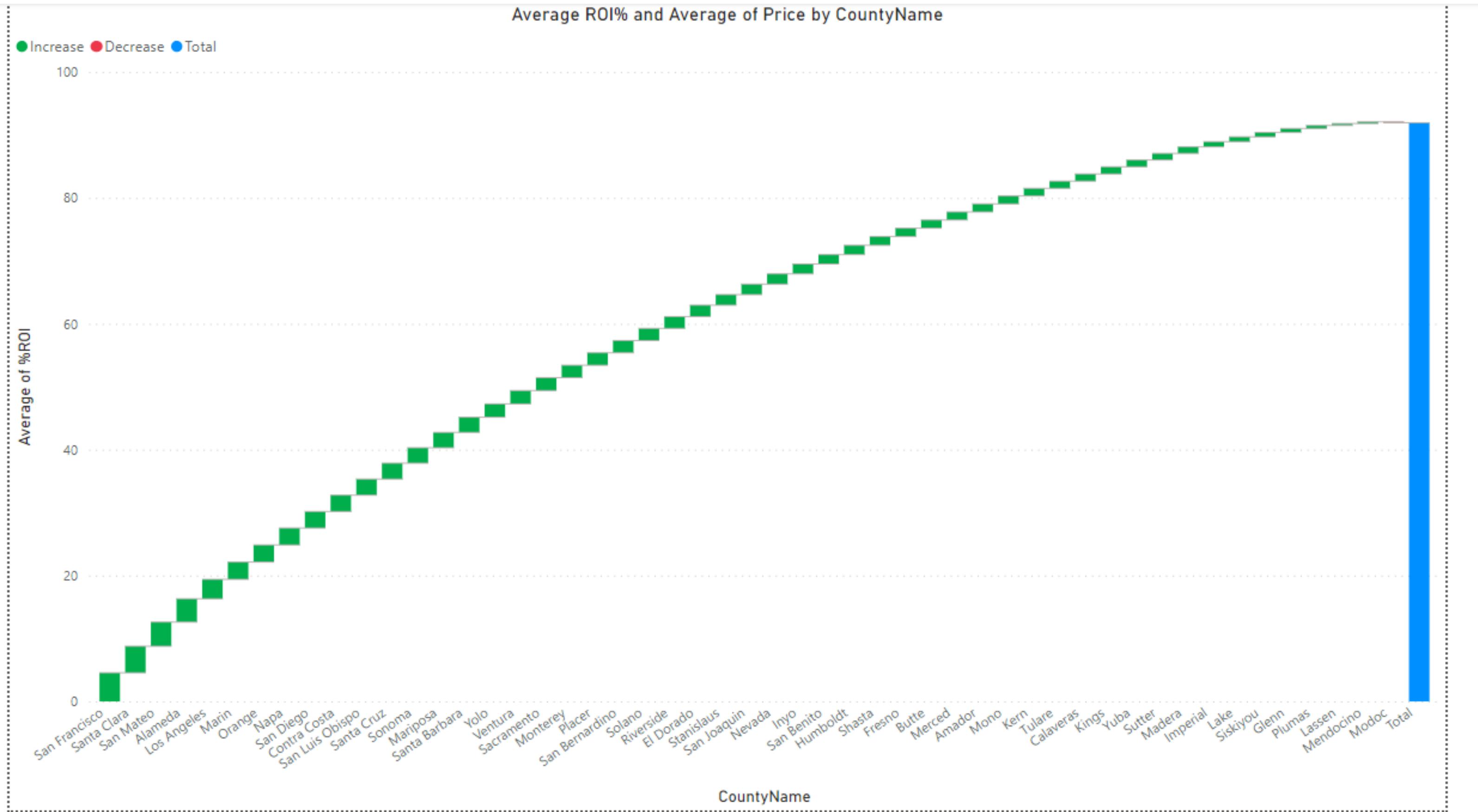
1. Did we have the right data?
2. Did we have the right question?
3. Do we need other data to answer our question?

Deployment via PowerBI

Average ROI% of each State







Zipcode

- 10456
- 10459
- 10461
- 10462
- 10463
- 10464
- 10465
- 10466

NY

State

New York

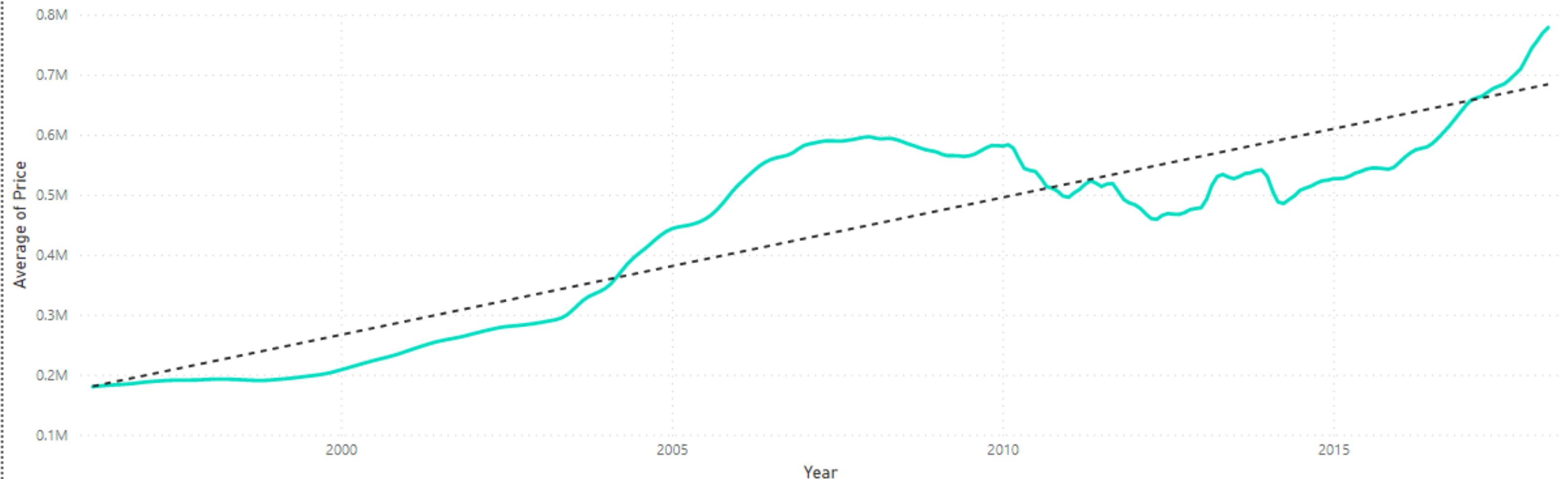
City

Bronx

First CountyName

Average of Price by Year, Quarter, Month and Zipcode

Zipcode • 10463



Thank you

Any question?