

Time Series Analysis of the San Antonio Metropolitan Area

Top Zip Codes for Investment Opportunities

Presenter: Melody Bass

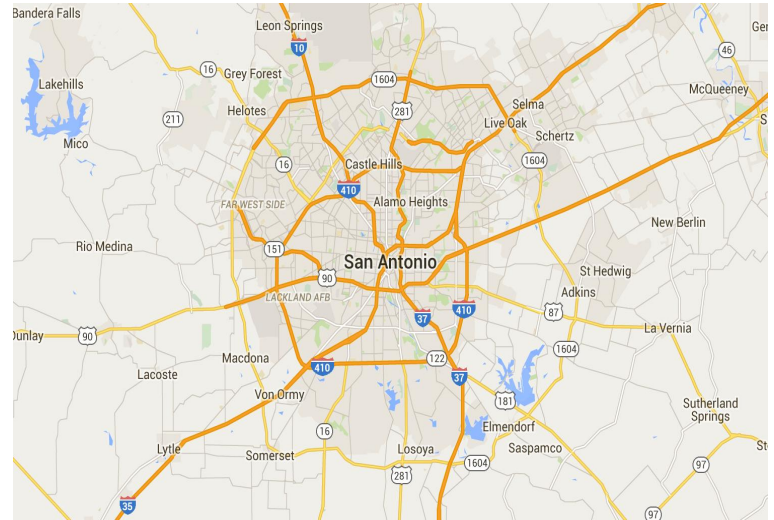
Background



- San Antonio is the 7th most populous city in the US and the fastest growing city among the top 10 largest
- One of the best places to visit and fastest growing economies in the US
 - Military
 - Health Care
 - Insurance
 - Tourism
- Build a time series model to forecast future home prices in the metro area

Business Case

- New real estate investment group wants to know the top 5 zip codes to invest in if they sell in 3 - 5 years
- They want the highest return on investment with the least amount of risk

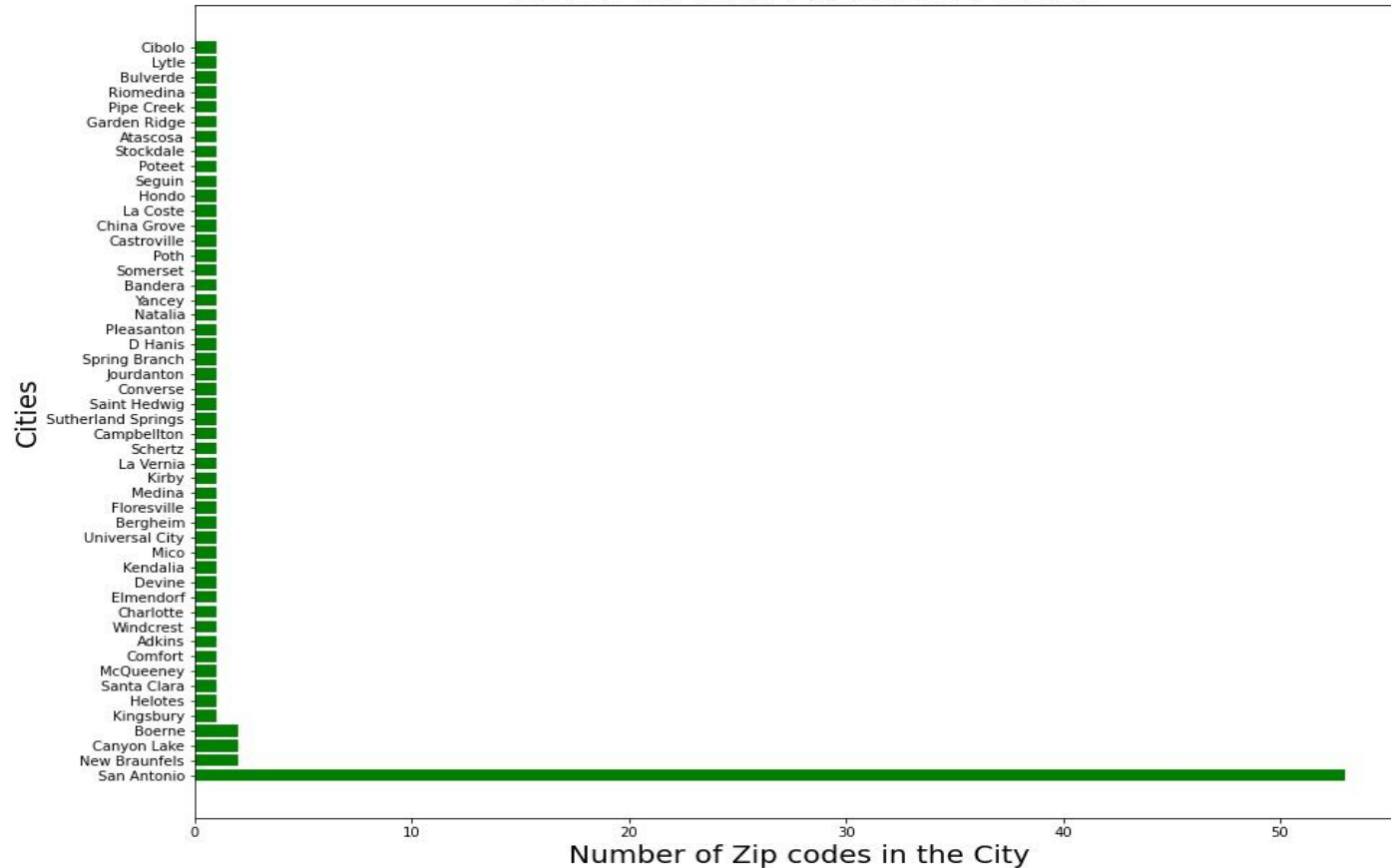


Data

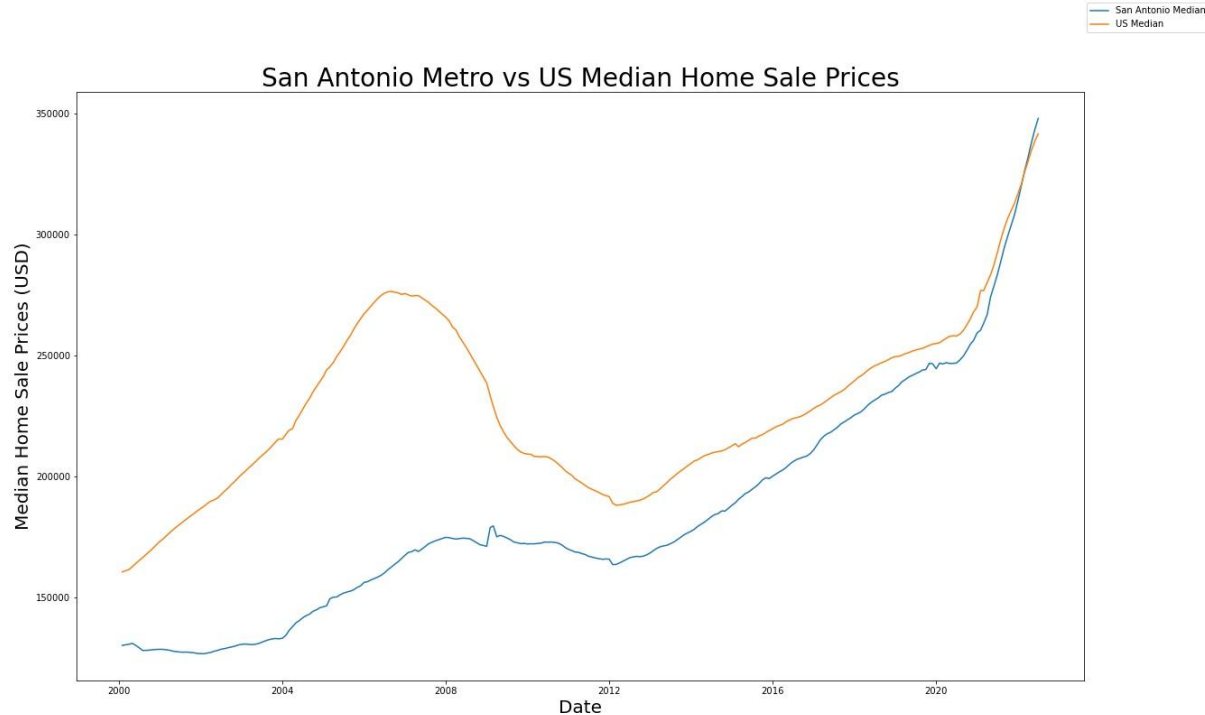
- Dataset downloaded on Zillow @ <https://www.zillow.com/research/data>
- Contains monthly median home sale prices for each zip code
- 33rd to 67th percentile for each zip code
- Data ranged from January 2000 - June 2022
- Filtered down to 105 zip codes in San Antonio metro area

The chart displays the average sale price in USD for various ZIP codes from 2000 to 2022. The y-axis represents the average sale price, ranging from 200,000 to 800,000 USD. The x-axis represents the year, with major ticks at 2004, 2009, 2014, and 2019. The chart shows a general upward trend in average sale prices over the period, with a significant acceleration in growth starting around 2018. A prominent yellow line, representing ZIP code 78223, shows the highest average sale price, starting around 400,000 USD in 2000 and rising sharply to over 800,000 USD by 2022. Other ZIP codes, such as 78209 (grey) and 78210 (teal), also show strong growth, reaching prices between 600,000 and 700,000 USD by 2022. The majority of the other ZIP codes, represented by various colored lines, show a steady increase in average sale price, with many reaching between 400,000 and 600,000 USD by 2022. The legend on the right lists 100 ZIP codes, including 78130, 78245, 78240, 78249, 78254, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 78250, 78251, 78253, 78209, 78223, 78230, 78258, 78250, 78216, 78247, 78233, 78155, 78201, 78109, 78213, 78229, 78227, 78207, 78006, 78232, 78217, 78154, 78218, 78108, 78210, 78132, 78221, 78212, 78260, 78237, 78259, 78239, 78244, 78023, 78238, 78133, 78242, 78211, 78148, 78261, 78214, 78222, 78114, 78070, 78224, 78220, 78015, 78064, 7

Cities in San Antonio Metro

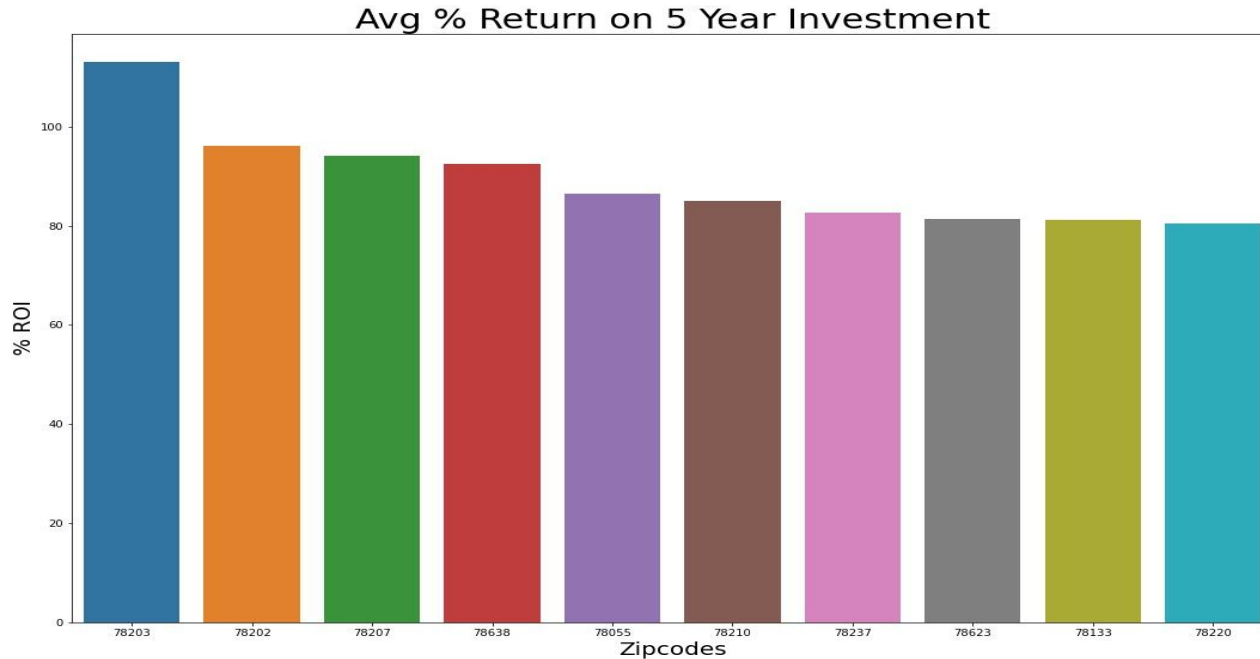


San Antonio Metro vs US



- Average median home value in the SA metro has surpassed the national average this year
- SA metro not as affected by 2008 crash

Avg % Return from 2017–2022



Modeling Methods

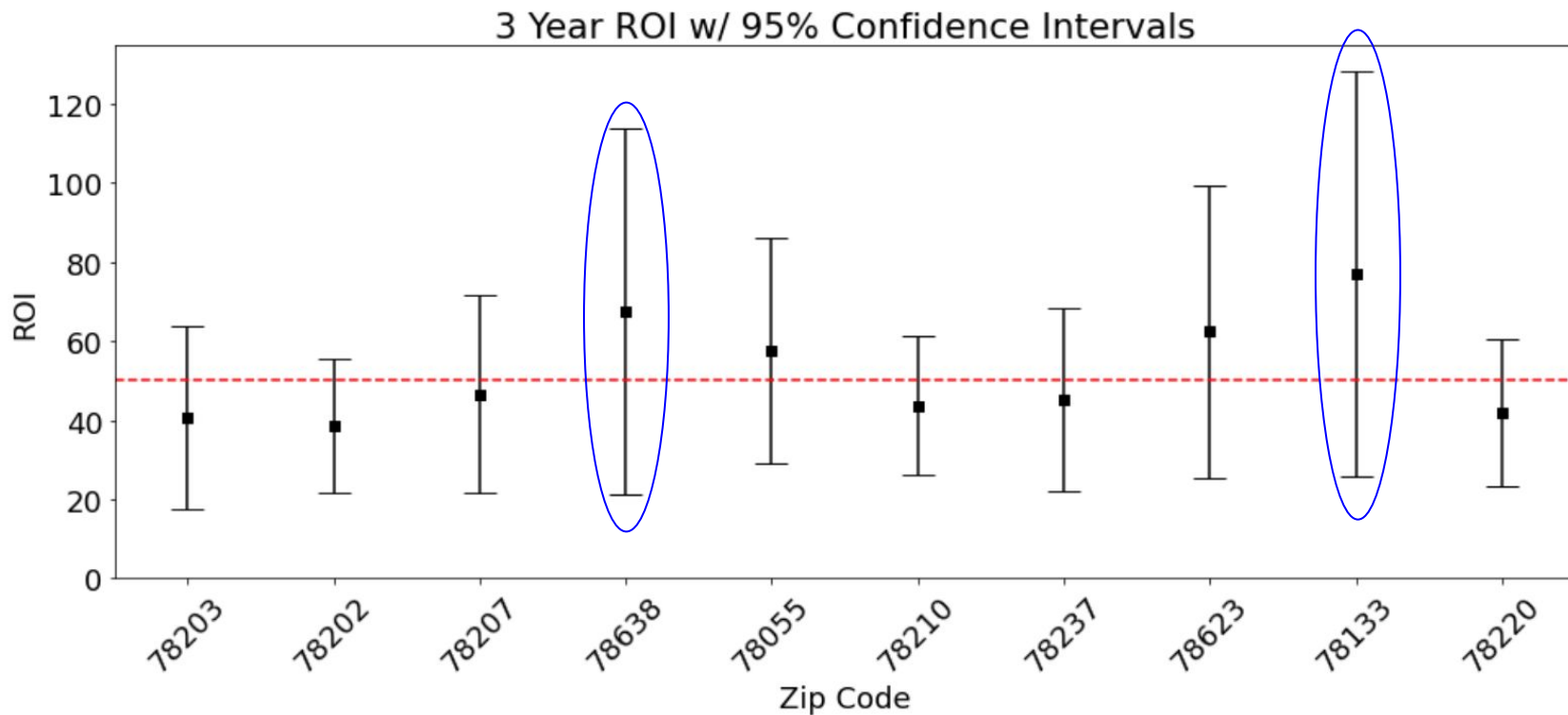
- SARIMAX Time Series Model on zip codes with highest ROI over last 5 years
- Dynamic Forecasting to predict house prices 3 and 5 years into the future
- Highest ROI with the lowest risk associated with purchase



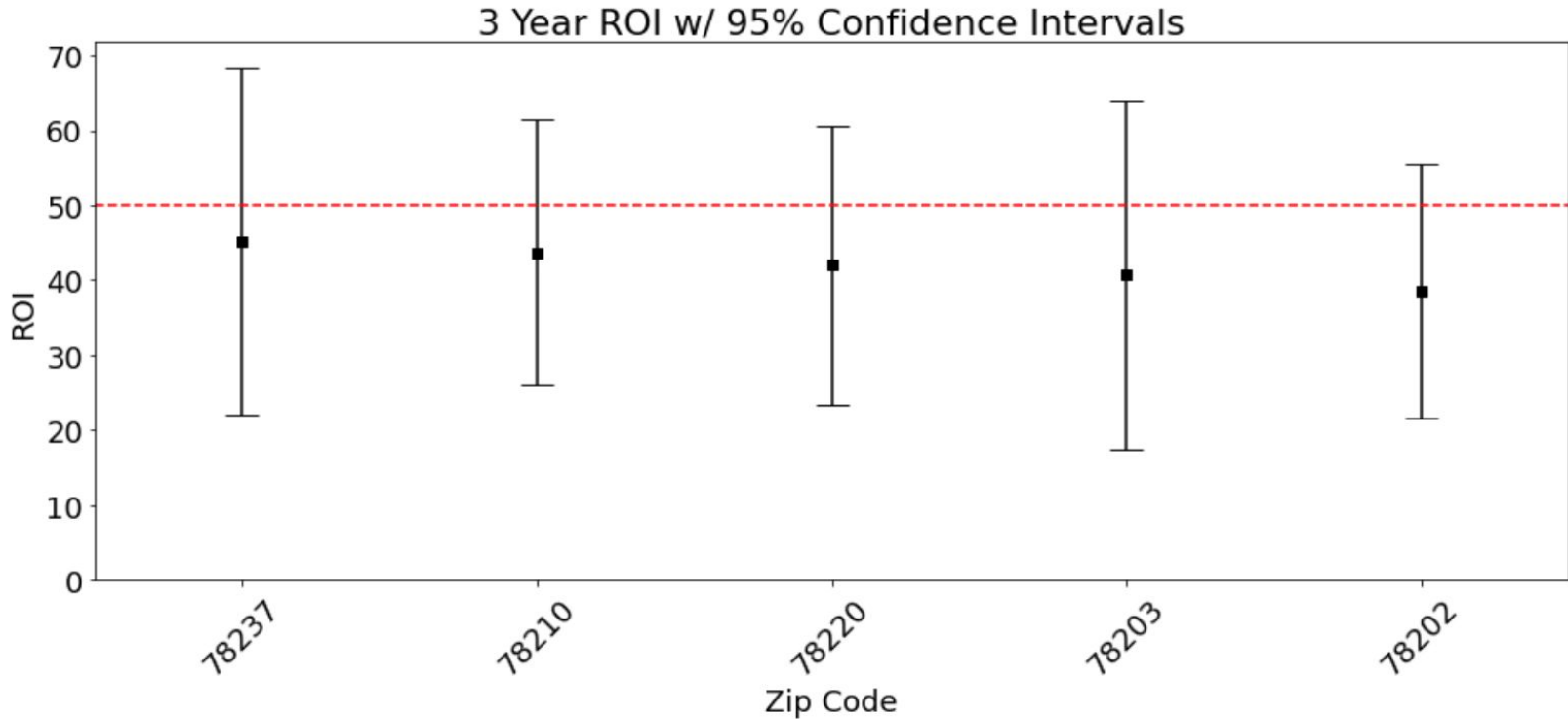
Top 10 Zip Codes 3 Year Projected ROI

	zipcode	predicted_mean	predicted_mean_min	predicted_mean_max	current_value	ROI	ROI_min	ROI_max
1	78202	316210.201653	277737.856239	3.546825e+05	228219.0	38.555599	21.697955	55.413242
0	78203	339839.659781	283808.209827	3.958711e+05	241568.0	40.680744	17.485847	63.875642
9	78220	260936.102386	226854.292676	2.950179e+05	183720.0	42.029231	23.478278	60.580183
5	78210	337287.142431	295798.772725	3.787755e+05	234712.0	43.702556	26.026267	61.378844
6	78237	237227.359318	199425.668841	2.750290e+05	163415.0	45.168656	22.036330	68.300982
2	78207	217501.235532	180366.222136	2.546362e+05	148461.0	46.503954	21.490642	71.517266
4	78055	569344.073180	465645.706910	6.730424e+05	361314.0	57.575979	28.875634	86.276325
7	78623	827218.413706	638932.679286	1.015504e+06	509544.0	62.344844	25.393034	99.296655
3	78638	930184.768415	673410.443085	1.186959e+06	555727.0	67.381604	21.176485	113.586724
8	78133	837285.818728	594395.248170	1.080176e+06	473175.0	76.950561	25.618481	128.282642

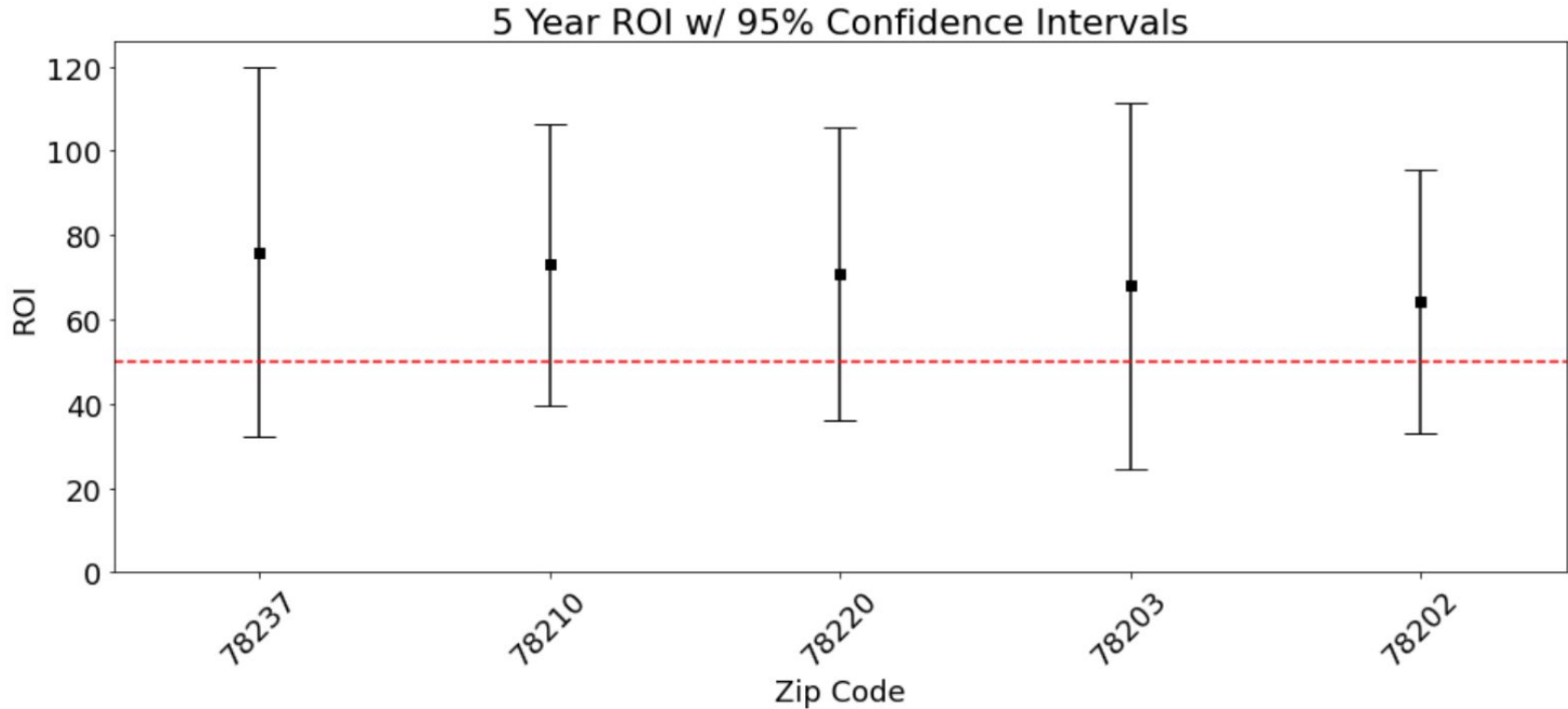
Top 10 Zip Codes 3 Year Projected ROI



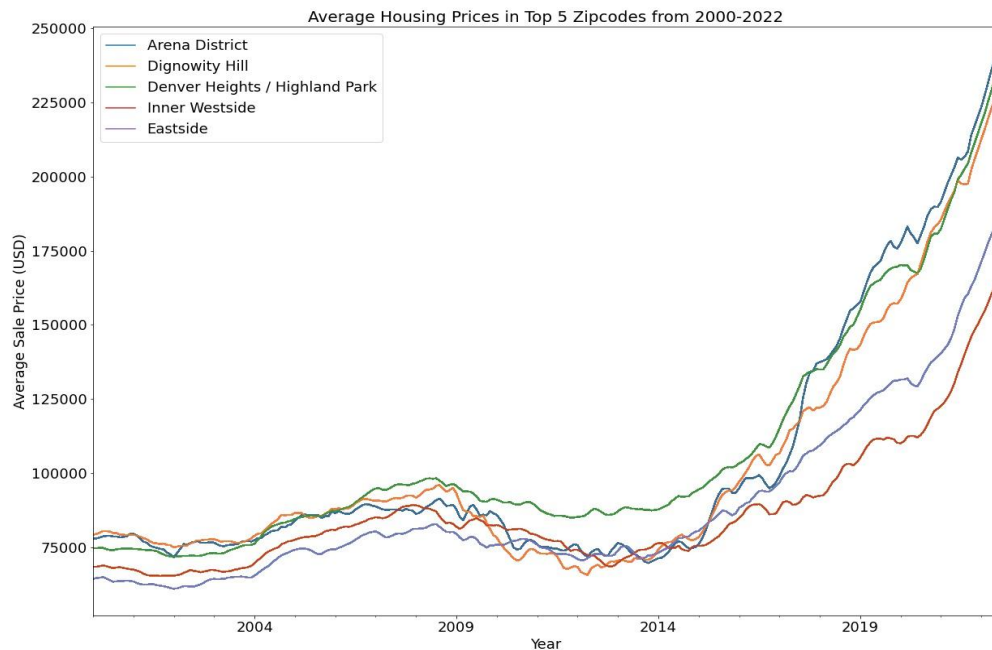
Top 5 Zip Codes 3 Year ROI Projection



Top 5 Zip Codes 5 Year ROI Projection

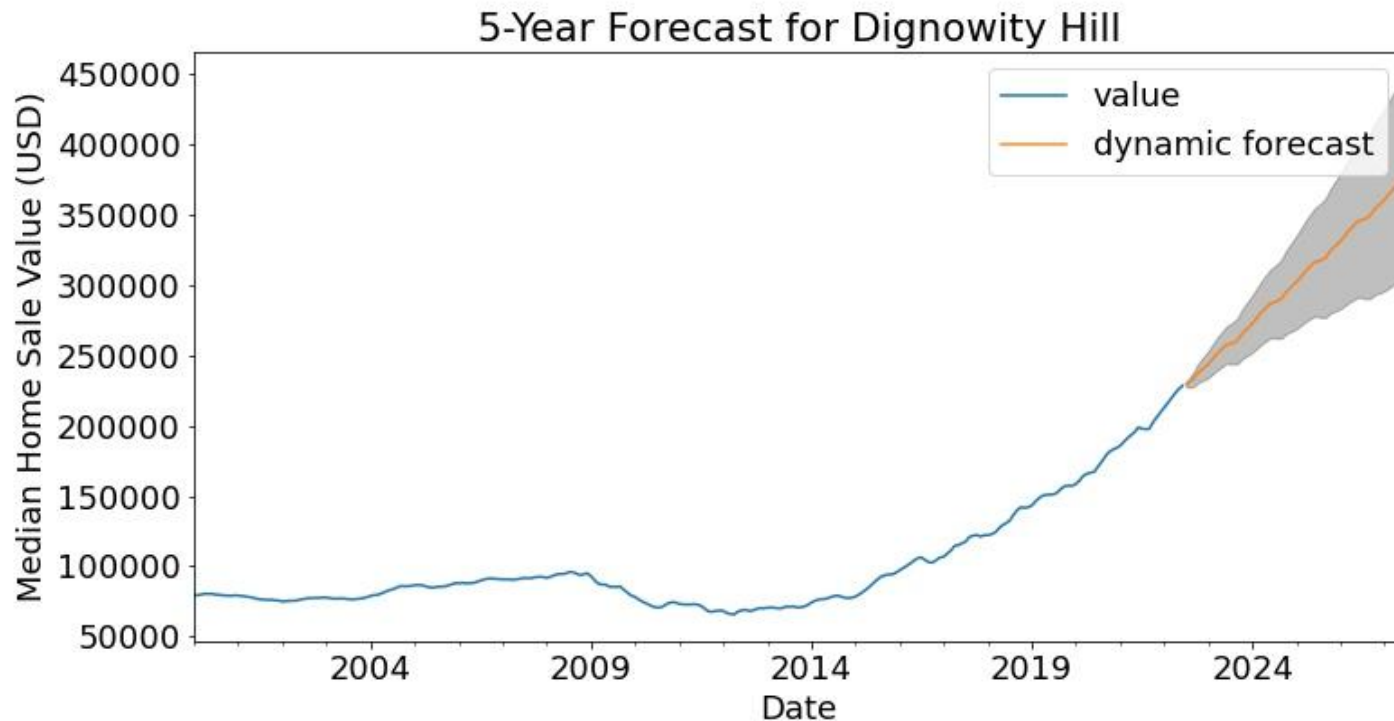


Top 5 Zip Codes Median Home Prices over Time

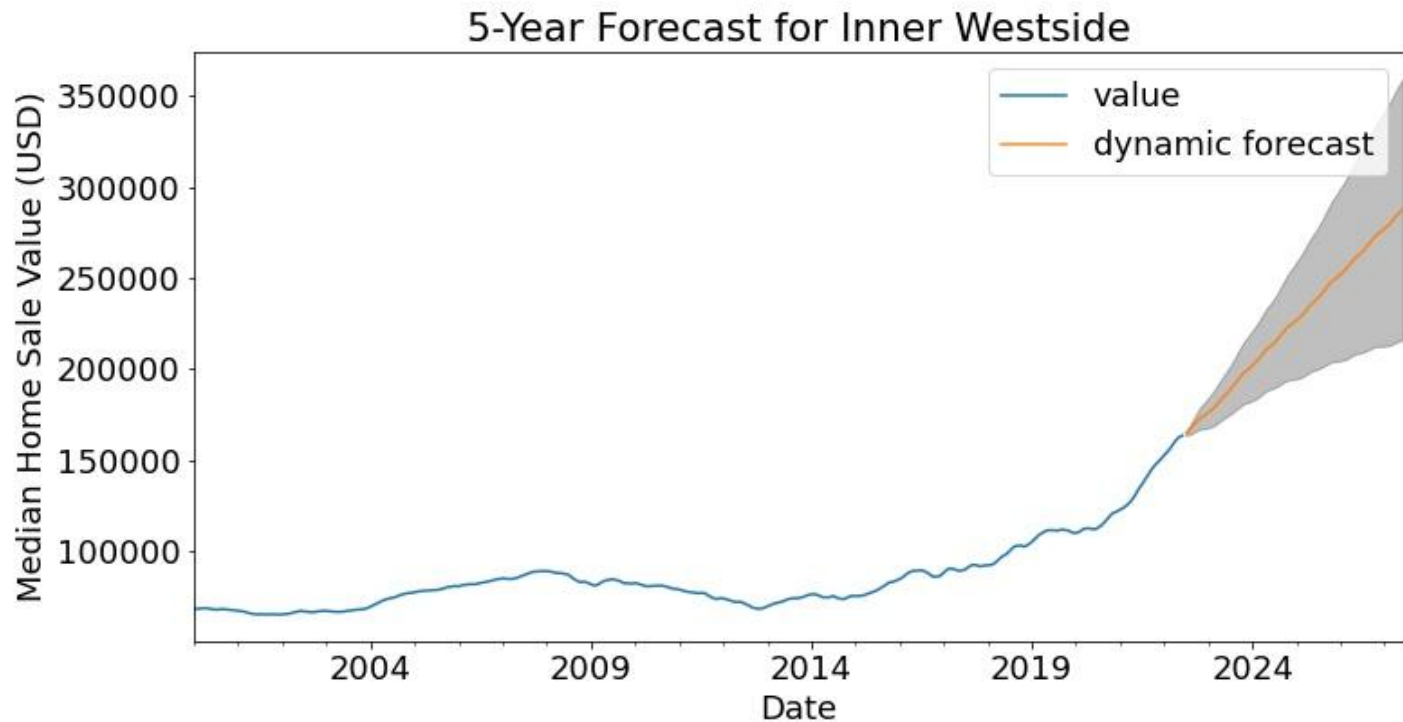


- Similar trend among top zip codes
- More pronounced in the Arena District, Dignowity Hill, and Denver Heights due to gentrification that has been taking place over past 4 years
- Inner Westside has highest projected ROI and lowest entry point into neighborhood
- Dignowity Hill is safest investment

5 Year Forecast for Dignowity Hill



5 Year Forecast for Inner Westside



Recommendations

- The top 5 zip codes ranked by highest return on investment (ROI) with the least amount of unpredictability and variation are:
 - 78237: Inner Westside (lowest entry point, highest ROI)
 - 78210: Denver Heights / Highland Park
 - 78220: Eastside
 - 78203: Arena District
 - 78202: Dignowity Hill (safest investment - smallest variation)
- High crime and below average school rating in all 5 neighborhoods
- If concerned, look at other zip codes in our top 10
 - Suburban areas with good schools, but higher price point and more risk

Future Work

- Add median income for each zip code to model
 - Observe changes over time as house prices increase
- Different modeling technique such as Facebook Prophet



THANK YOU!

Email : meljoy1099@gmail.com

Github Repo: <https://github.com/meljoy1099/housing-price-forecast-time-series-modeling>