Fair Market Rent Pricing Exploration

An exploration of Fair Market Rent as it relates to various features

Exploring Rent Prices

- We have chosen to analyze historic rent prices across the U.S. based on year, state, population, and number of bedrooms.
- There is a plethora of datasets relating to historic real estate prices but surprisingly little when it comes to nationwide rent prices.

Fair Market Rent

Fair Market Rents, are estimates of 40th percentile gross rents for standard quality units within a metropolitan area or nonmetropolitan county.

Fair Market Rents, as set by the US Department of Housing and Urban Development (HUD) are used in the following circumstances:

- To determine payment standard amounts for the Housing Choice Voucher program
- To determine initial renewal rents for some expiring project-based Section 8 contracts
- To determine initial rents for housing assistance payment (HAP) contracts in the Moderate Rehabilitation Single Room Occupancy program (Mod Rehab)
- rent ceilings for rental units in both the HOME Investment Partnerships program and the Emergency Solution Grants program,
- calculation of maximum award amounts for Continuum of Care recipients and the maximum amount of rent a recipient may pay for property leased with Continuum of Care funds, and calculation of flat rents in Public Housing unit

Fair Market Rent Dataset

- We have used fair market rent datasets from the U.S. Department of Housing and Urban Development (HUD).
- The dataset, provided in annual csv files, contains information on rental prices broken down by number of bedrooms, area name, county, state, population, and other classifiers around metro area and location information
- The datasets are all available at the HUD website: https://www.huduser.gov/portal/datasets/fmr.html#2022

What will the dataset tell us?

With this dataset, our machine learning model will show:

- What features have the greatest influence on rental prices?
- How does change in features like location or population affect rental prices?
- Which markets have shown the most dramatic increase in rent?
- Which markets are predicted to have the smallest increase in rent prices?

Raw data

]:

	fips2010	fmr_0	fmr_1	fmr_2	fmr_3	fmr_4	state	metro_code	areaname	countyname	county_town_name	pop2017	state_alpha	metro
4760	7215199999	428	466	538	719	868	72	METRO41980MM7440	San Juan-Guaynabo, PR HUD Metro FMR Area	Yabucoa Municipio	NaN	35025	PR	1
4761	7215399999	362	370	422	572	574	72	METRO49500M49500	Yauco, PR MSA	Yauco Municipio	NaN	37585	PR	1
4762	7801099999	868	886	1082	1338	1467	78	NCNTY78010N78010	St. Croix Island, VI	St. Croix	NaN	53234	VI	0
4763	7802099999	1154	1368	1700	2101	2305	78	NCNTY78020N78020	St. John Island, VI	St. John	NaN	4197	VI	0
4764	7803099999	832	1001	1253	1549	1699	78	NCNTY78030N78030	St. Thomas Island, VI	St. Thomas	NaN	51181	VI	0

Data Exploration

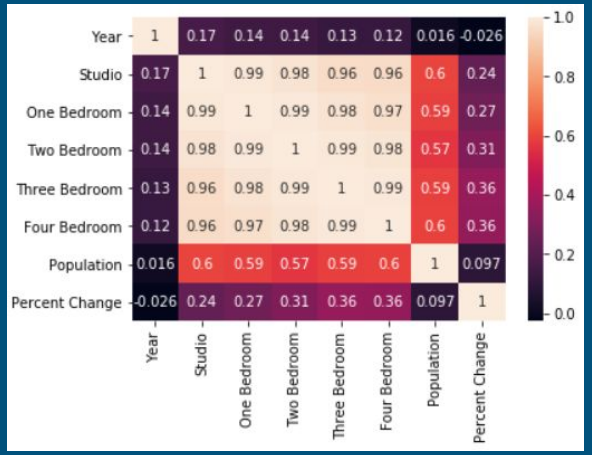
The initial HUD datasets contained some data that required transformation and some excess data, including:

- There were several columns such as state number, areaname, county_town_name, and metro that provided no insight to our model. Each of those columns were dropped.
- The initial identifiers for studio and 1-4 bedrooms were renamed to more clearly label the data.
- The ‘state_alpha’ column was renamed to ‘State’ for clarification and to allow for better grouping of the data.
- The year was added as a column in each cleaned annual dataframe to be able to combine all the data grouped by state into a single dataframe to allow for trend analyzation.

Exploratory Data Analysis

For each year's set of data:

- Rental prices were grouped and averaged by state.
- Populations were also averaged to show the mean population per county within each state.
- Dropped unnecessary columns
- Renamed columns

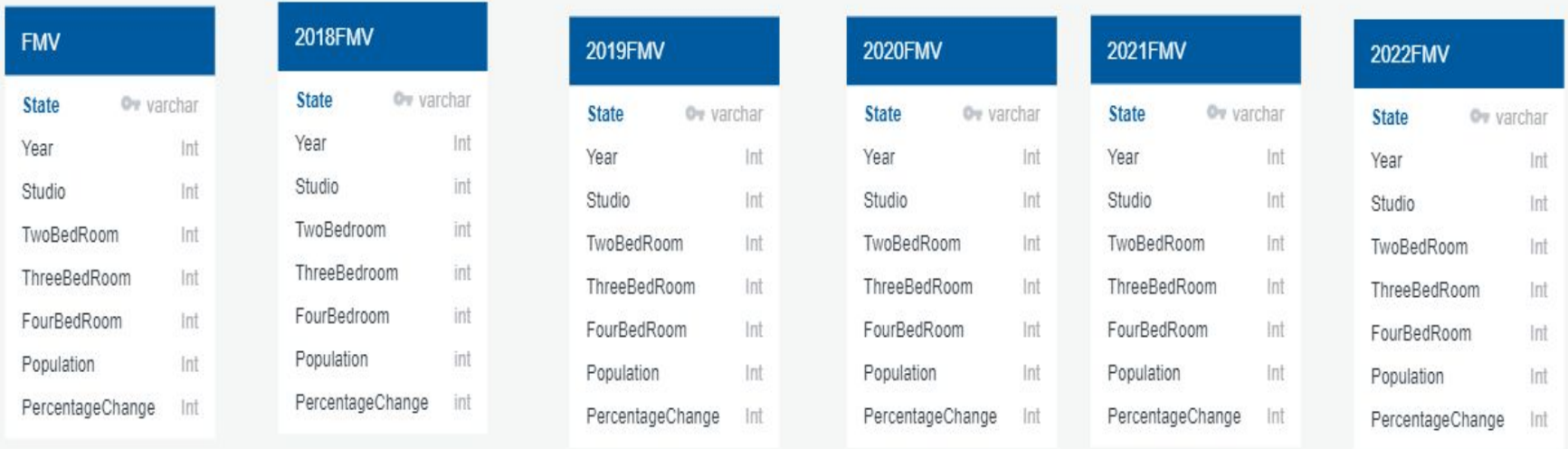


Database Integration Overview

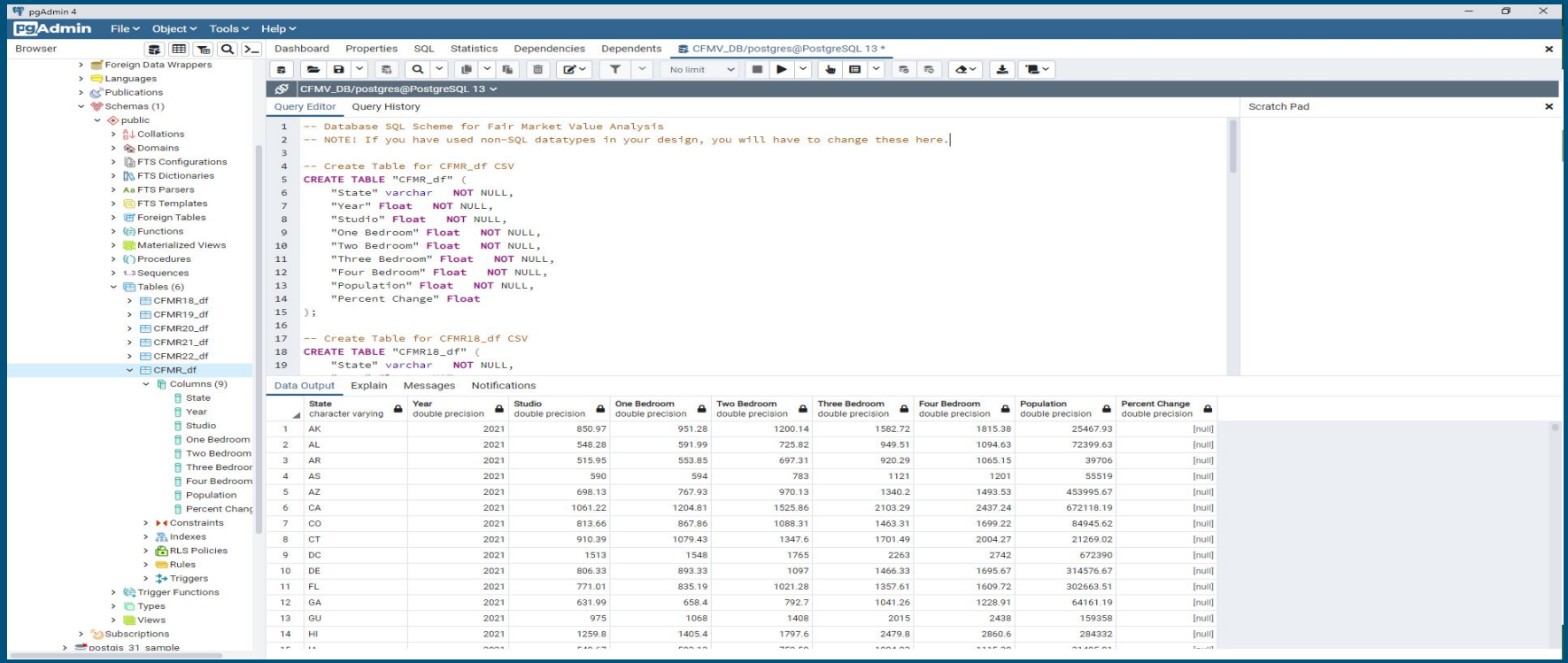
- Database stores cleaned HUD data sets for use
- Database interfaces with the project by also storing the predictive models and connecting to the dashboard
- Will include each cleaned year’s data set as well as combined cleaned static data for 2018-2022.
- Tables will be joined on state to allow for dashboard to pull historic and predictive data together.

Database Explanation

www.quickdatabasediagrams.com

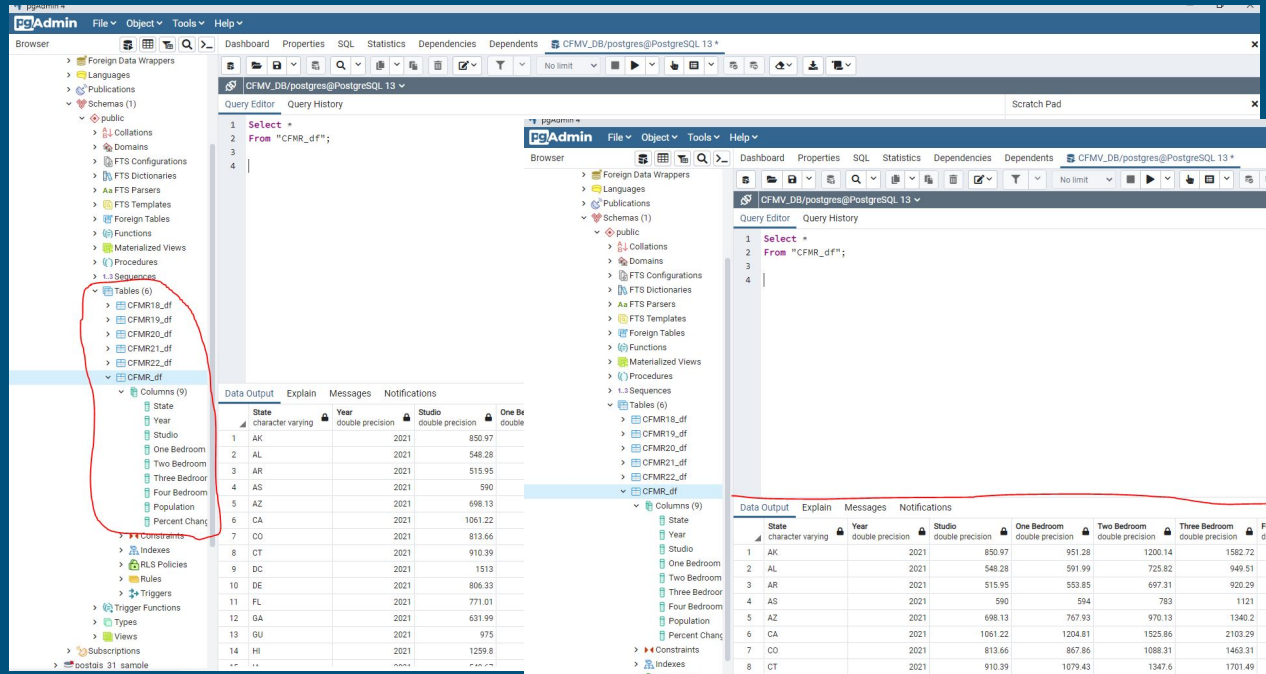


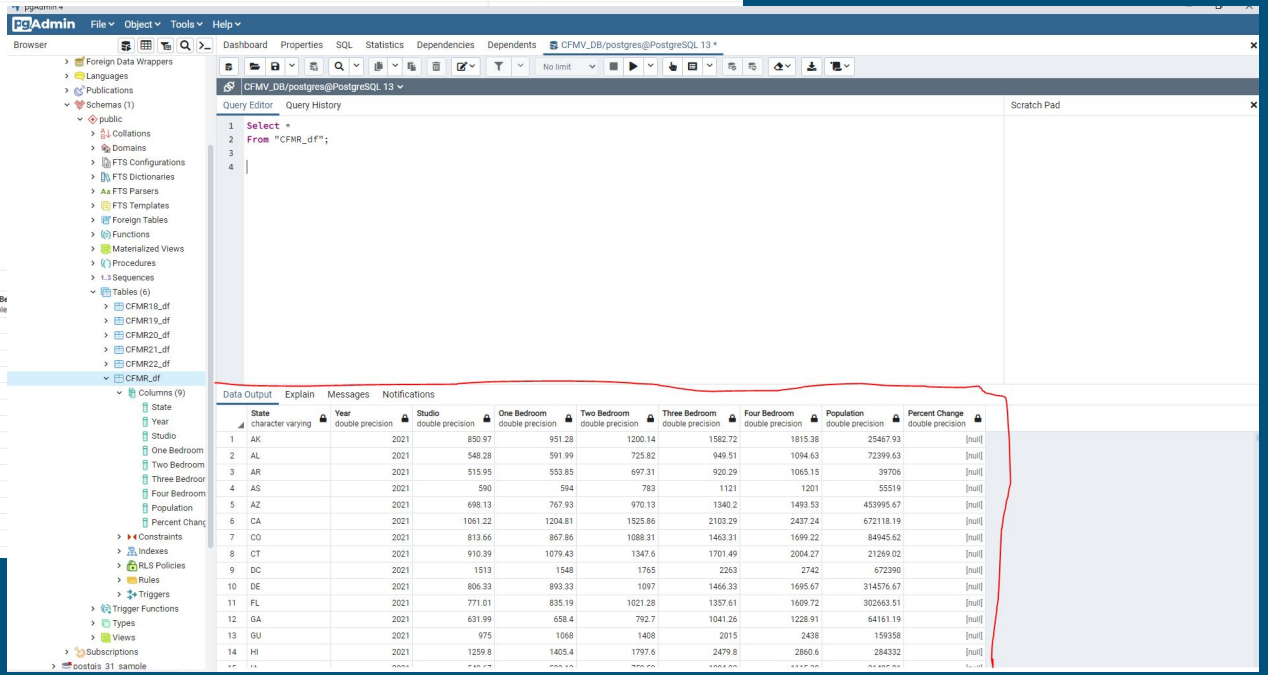
Database Explanation



	State character varying	Year double precision	Studio double precision	One Bedroom double precision	Two Bedroom double precision	Three Bedroom double precision	Four Bedroom double precision	Population double precision	Percent Change double precision
1	AK	2021	850.97	951.28	1200.14	1582.72	1815.38	25467.93	[null]
2	AL	2021	548.28	591.99	725.82	949.51	1094.63	72399.63	[null]
3	AR	2021	515.95	553.85	697.31	920.29	1065.15	39706	[null]
4	AS	2021	590	594	783	1121	1201	55519	[null]
5	AZ	2021	698.13	767.93	970.13	1340.2	1493.53	453995.67	[null]
6	CA	2021	1061.22	1204.81	1525.86	2103.29	2437.24	672118.19	[null]
7	CO	2021	813.66	867.86	1088.31	1463.31	1699.22	84945.62	[null]
8	CT	2021	910.39	1079.43	1347.6	1701.49	2004.27	21269.02	[null]
9	DC	2021	1513	1548	1765	2263	2742	672390	[null]
10	DE	2021	806.33	893.33	1097	1466.33	1695.67	314576.67	[null]
11	FL	2021	771.01	835.19	1021.28	1357.61	1609.72	302663.51	[null]
12	GA	2021	631.99	658.4	792.7	1041.26	1228.91	64161.19	[null]
13	GU	2021	975	1068	1408	2015	2438	159358	[null]
14	HI	2021	1259.8	1405.4	1797.6	2479.8	2860.6	284332	[null]

Database Explanation





Machine Learning Models Tested

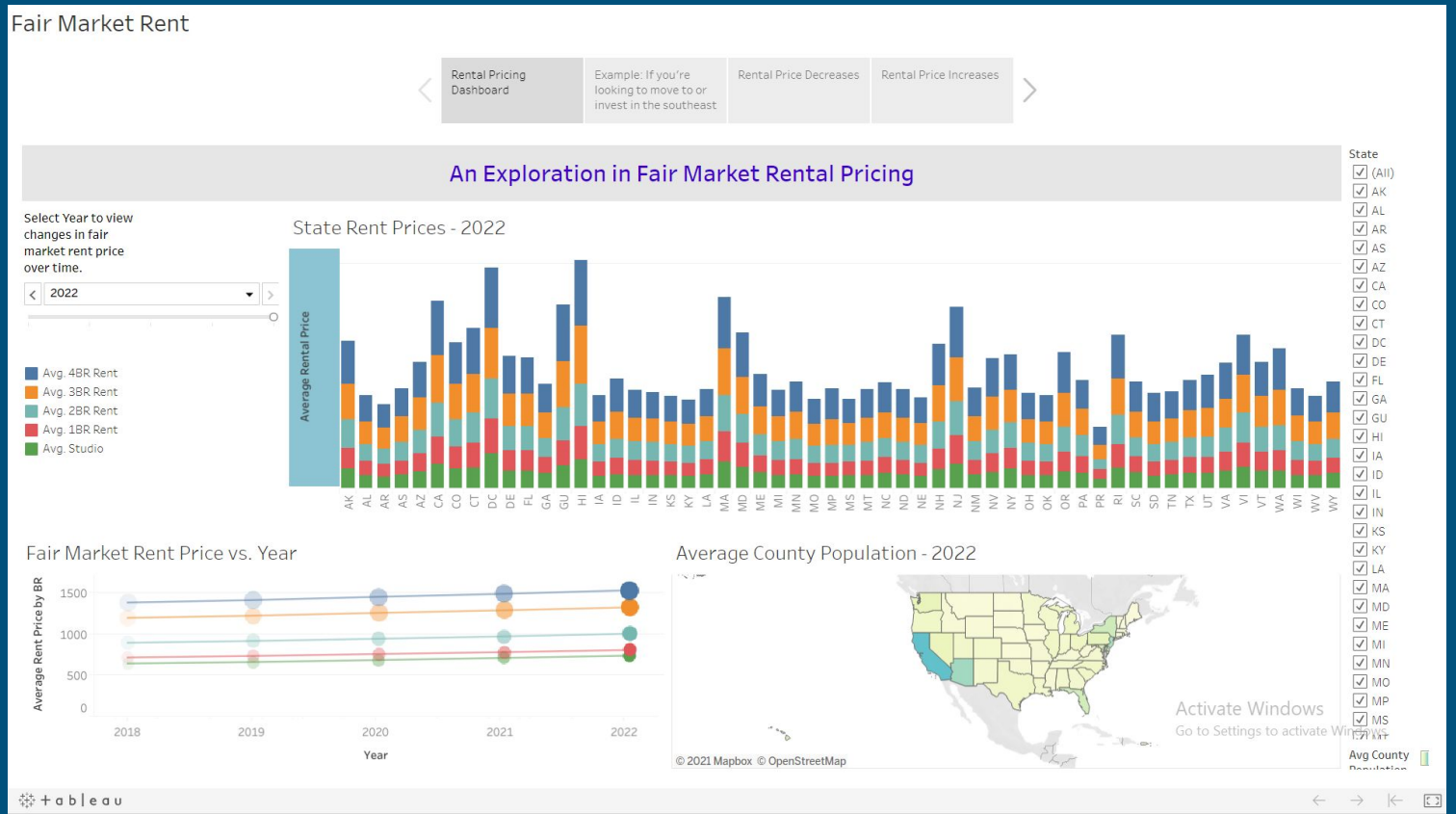
- **Simple Linear Regression Analysis**
- **Gradient Boosted Regressor Model (GBR)**
- **Quadratic Regression Model**
- **The K-Nearest Neighbors (KNN) Regression Model**

KNN Regression model provided highest confidence level

```
print(confidencereg)
#The linear regression confidence
print(confidencepoly2)
#The quadratic regression 2 confidence
print(confidencepoly3)
#The quadratic regression 3 confidence
print(confidenceknn)
#The knn regression confidence
```

```
0.2939320660031093
0.3425768529164398
0.3800495196980026
0.8936304660815191
```

Tableau Dashboard



Results

The general overview of the data from a nationwide perspective appears as expected, with rent prices increasing at a gradual rate as time moves forward. We can take a look at a few individual states and see that HUD doesn’t just increase Fair Market Rent exponentially each year.