

Analyzing Neighborhood Characteristics of Affordable Housing Under 421a

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Introduction

New York is facing an affordable housing crisis, with 1 million New Yorkers falling in the lowest income brackets and only 425,000 units available in the corresponding affordability range.

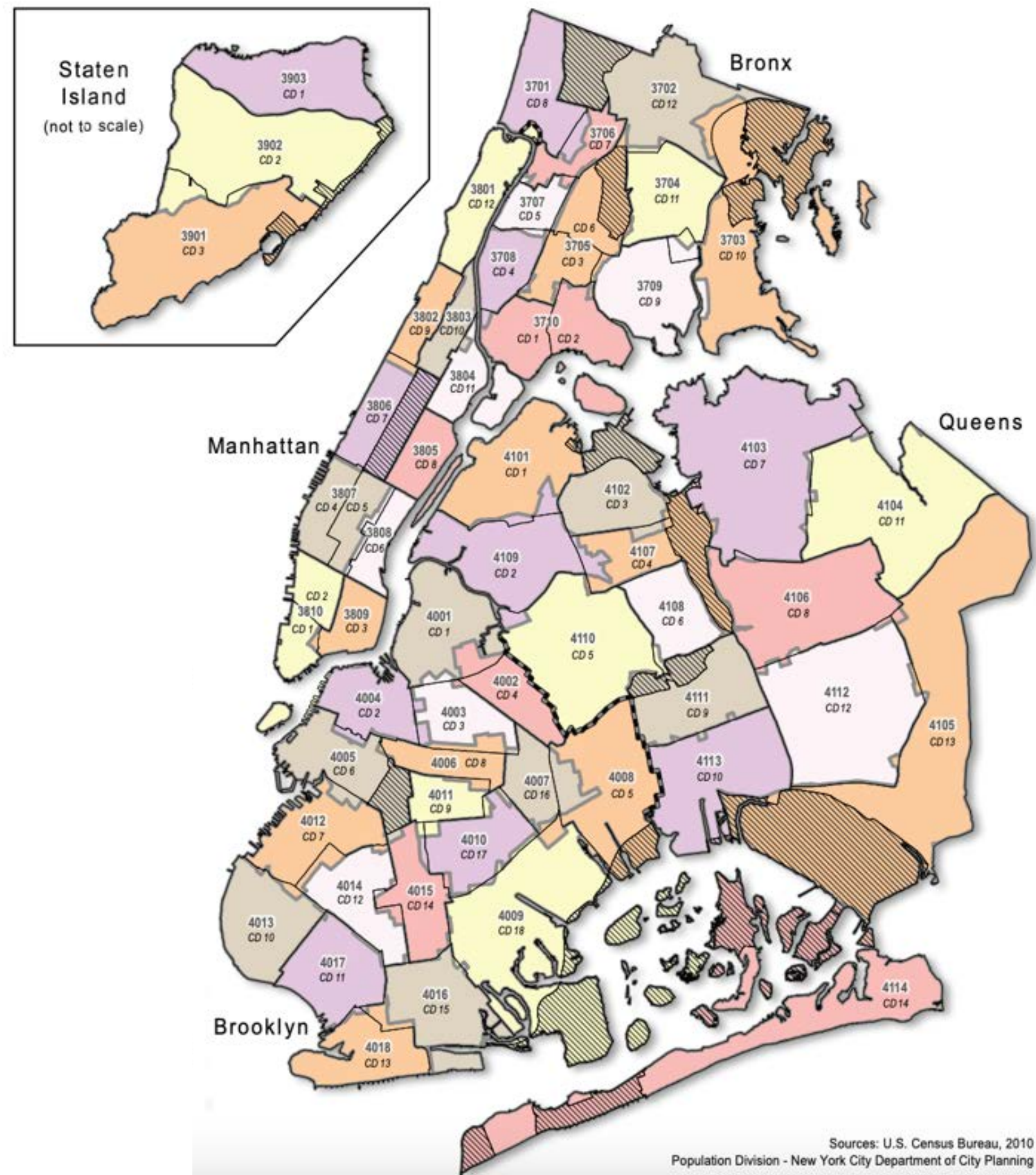
Housing New York was initiated by the City in 2016, with the goal of providing an additional 300,000 affordable units by 2026.

One program under Housing New York is the 421a Tax Incentive, which grants a tax abatement to new housing developments that include at least 20% affordable units.



Problem Statement

Analyze characteristics of neighborhoods where new developments are taking place, and see if there are any features that are able to inform whether or not a development will receive a tax abatement under 421a. These factors, if any, may indicate bias in the application of 421a and help to inform future iterations.



Data

Neighborhood Characteristics

NYU Furman Center

Property Exemption Detail

NYC Department of Finance

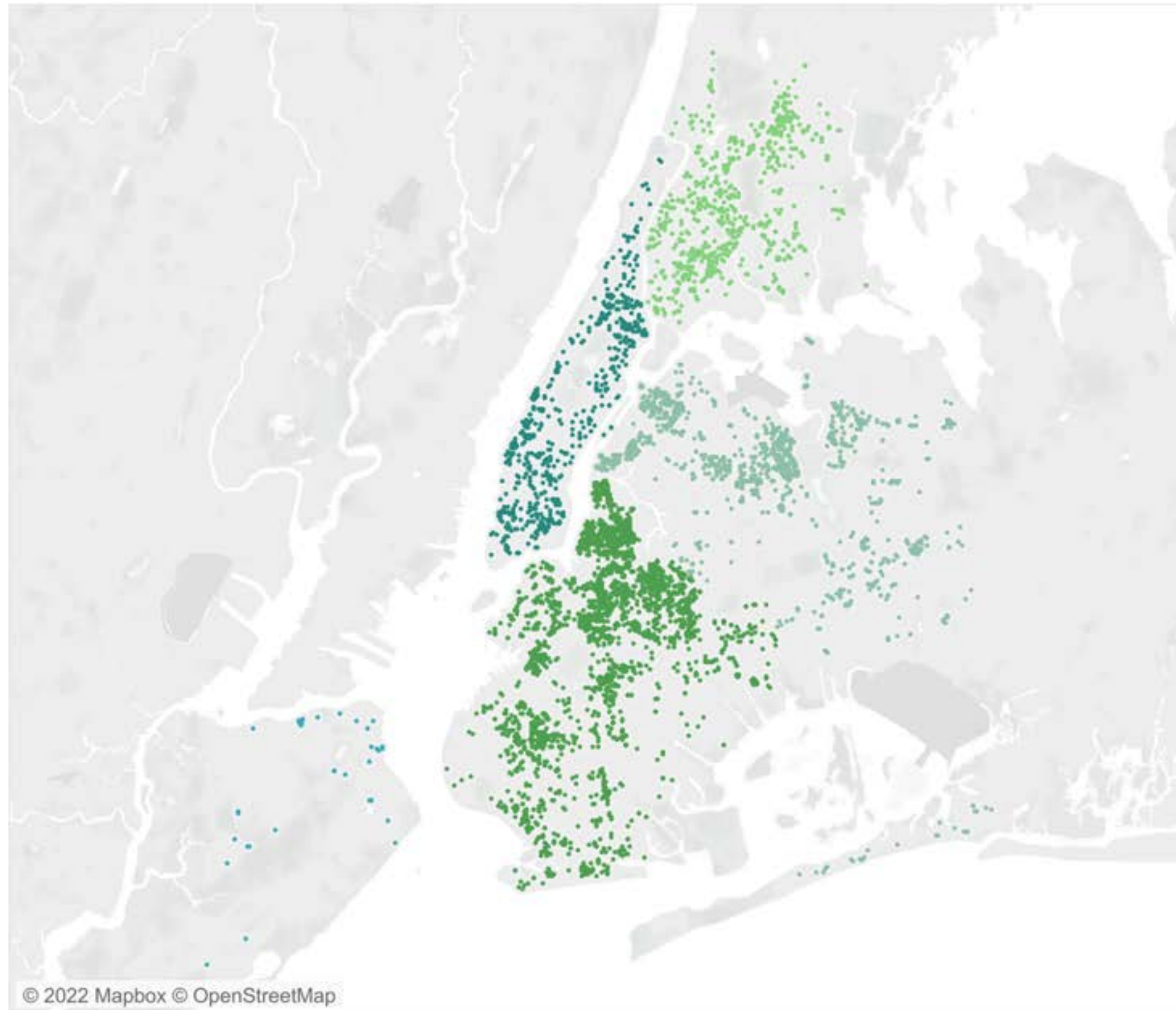
Housing Database

NYC Department of City Planning Housing Database

Example Neighborhood Characteristics

- Median sale/rental price per unit
- Number of real estate transactions
- Number of mortgage foreclosures
- Average price changes in repeated sale of the same property
- Population density
- Median household income

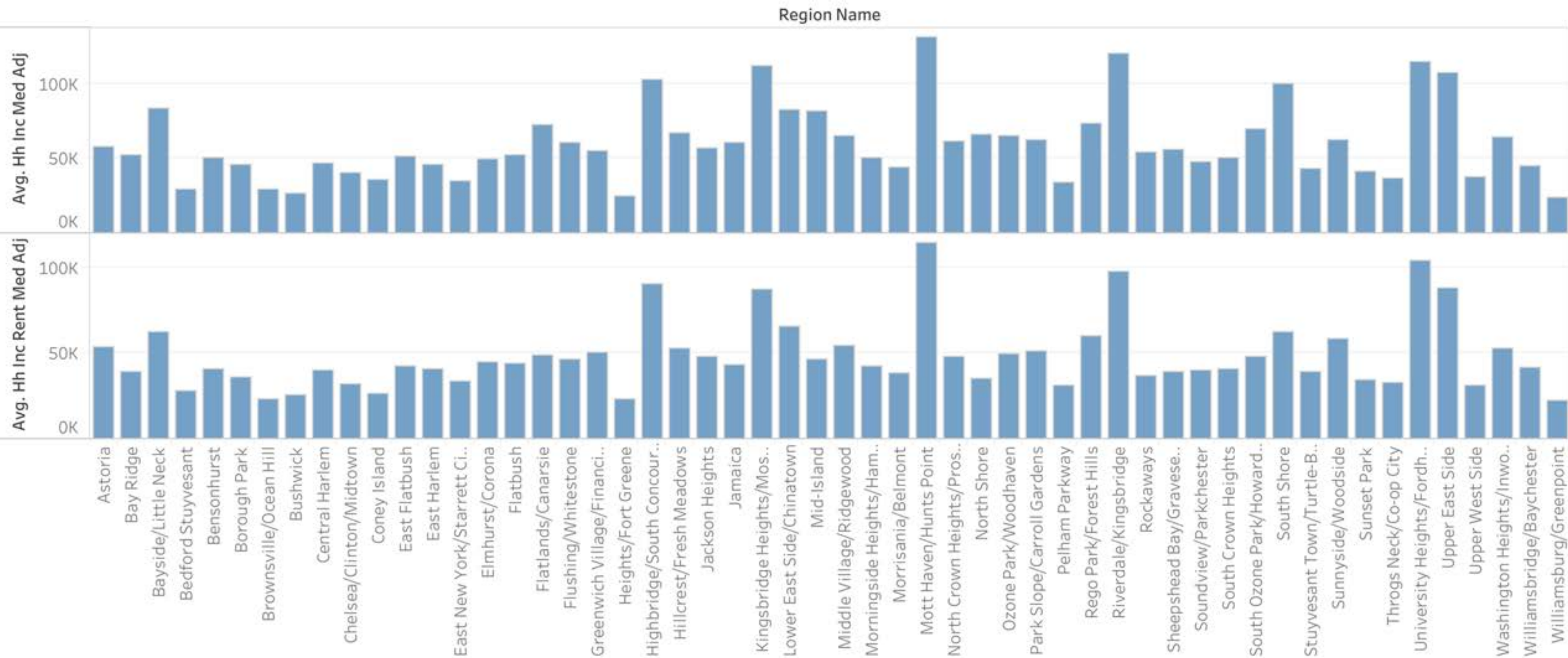
New Multifamily Residential Projects

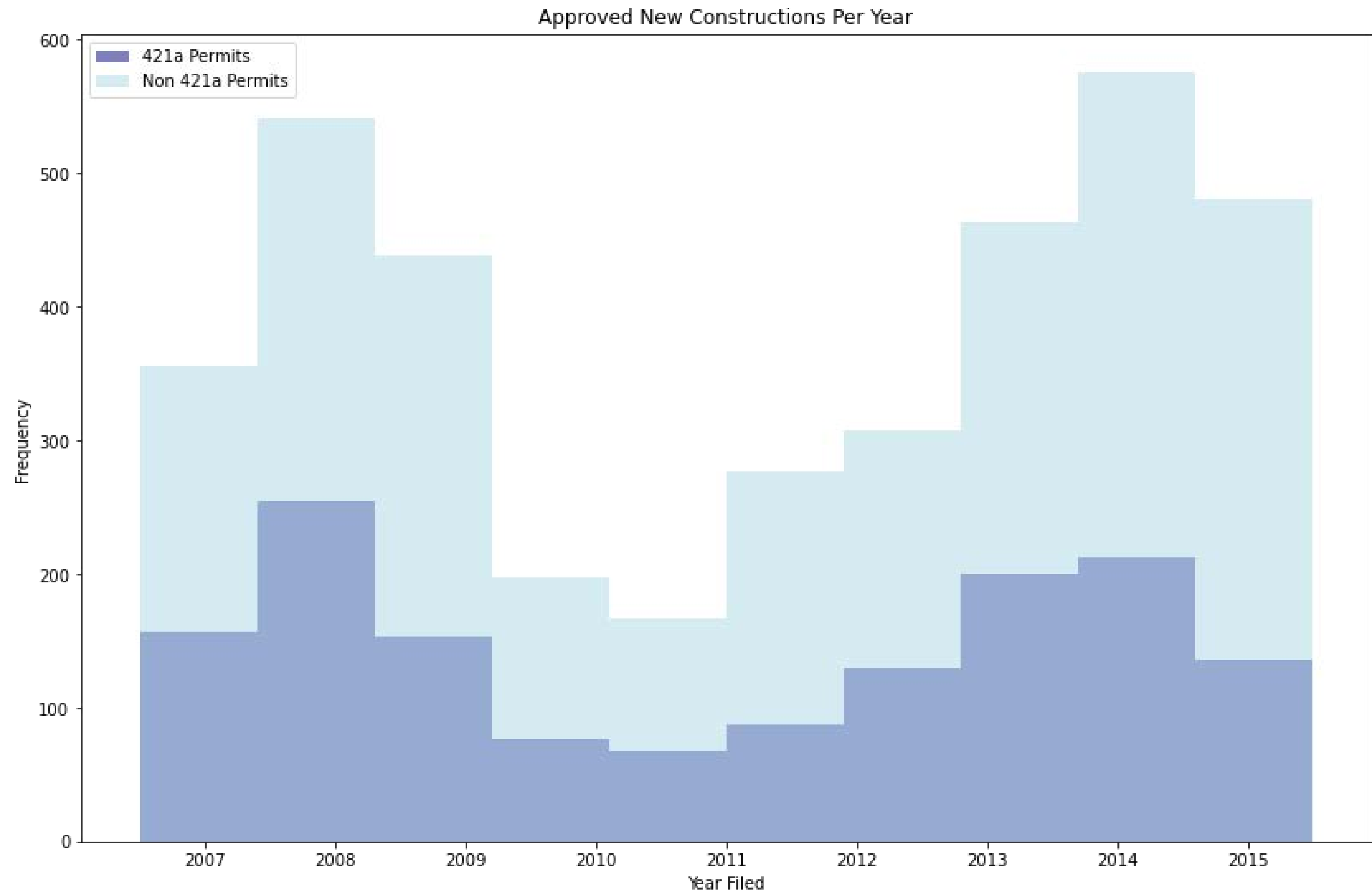


- Bronx
- Brooklyn
- Manhattan
- Queens
- Staten Island

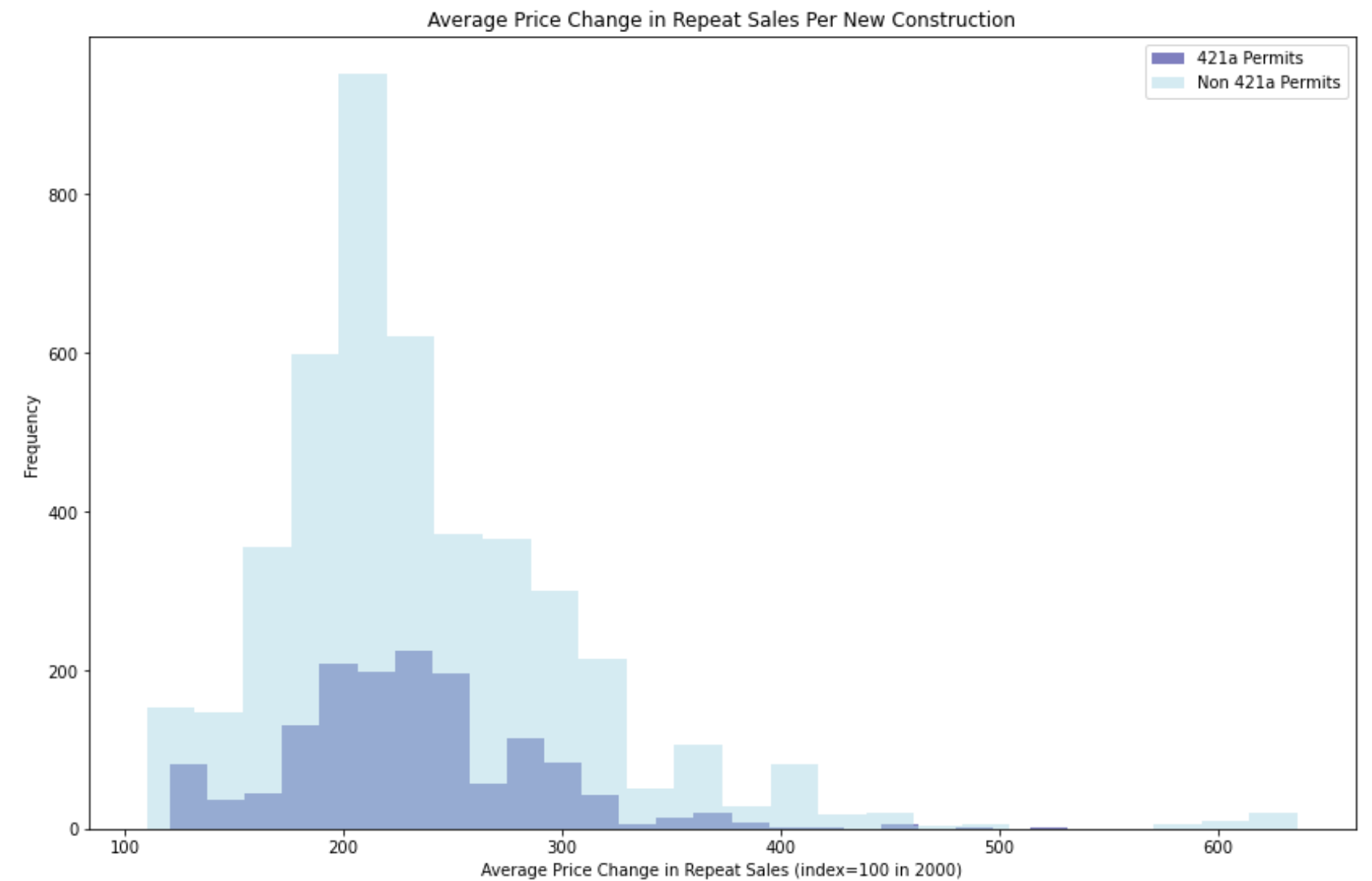
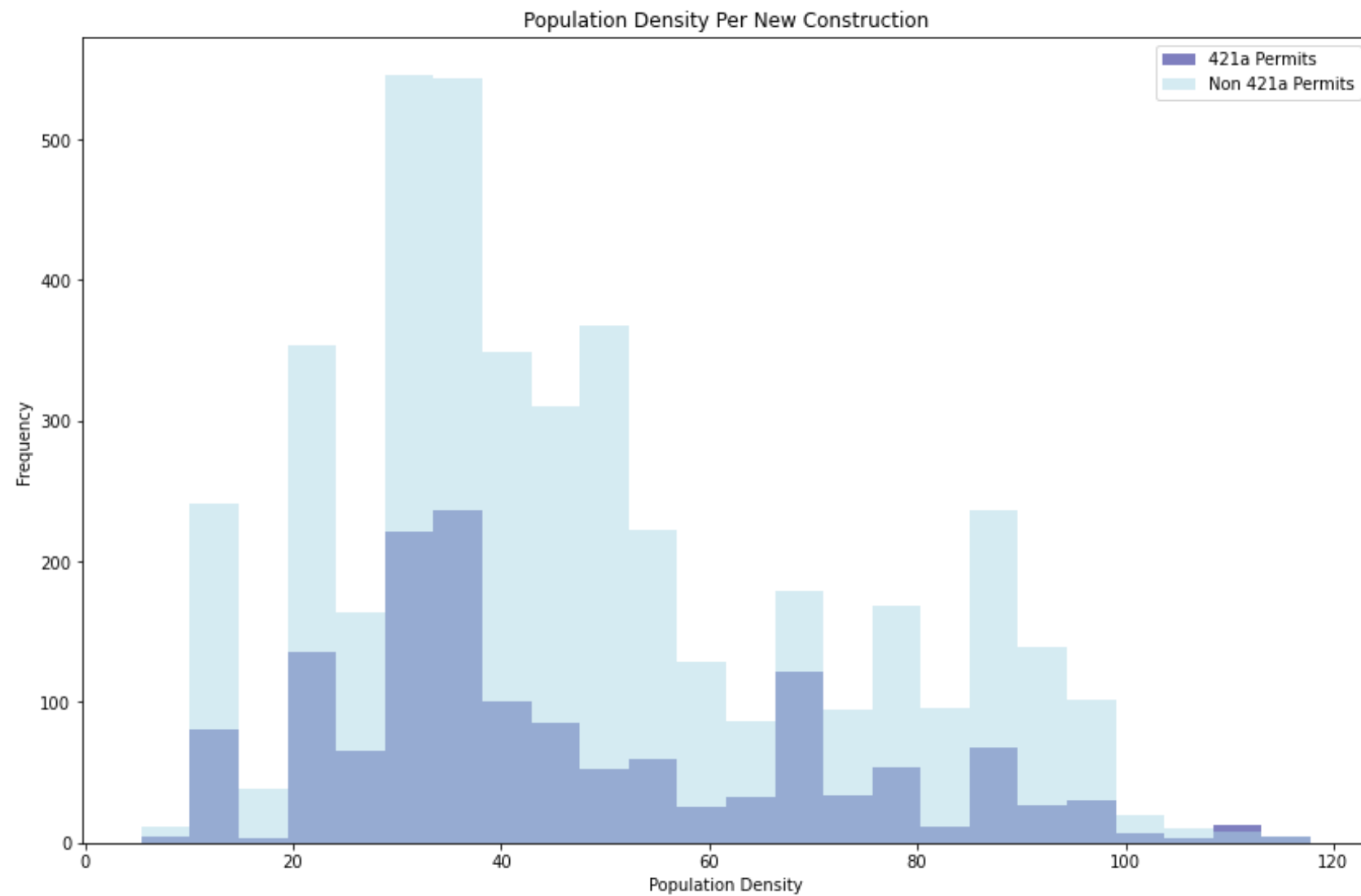
Exploratory Data Analysis

Median Household Income and Rent by Neighborhood





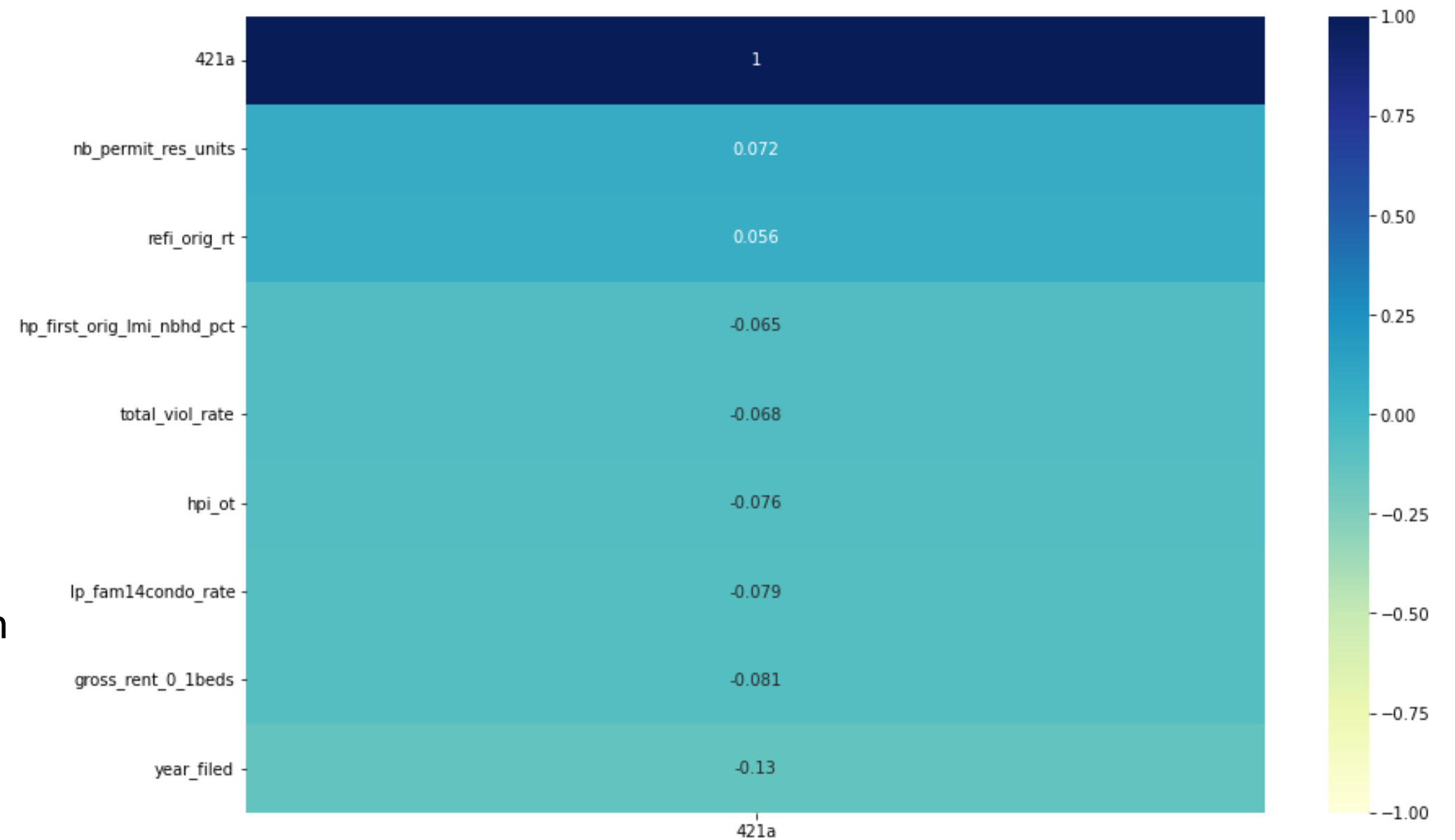
Exploratory Data Analysis



Feature Selection

Final features

- Number of units authorized by new residential building permits
- Number of refinance loans originations
- Number of first-lien home purchase loan originations
- Number of Housing Department violations
- Average price changes in repeated sales of the same property
- Rate of mortgage foreclosure actions
- Median gross rent among studios and 1-bedroom units
- Year filed



Model Selection

	model	cross_val_score	train_score	test_score	train_accuracy	test_accuracy
0	Logistic Regression	0.746495	0.746495	0.760678	0.746495	0.760678
1	KNN	0.713707	0.764586	0.739661	0.764586	0.739661
2	Decision Tree	0.739033	0.786296	0.770169	0.786296	0.770169
3	Random Forest	0.732024	0.786296	0.766102	0.786296	0.766102
4	AdaBoost	0.748078	0.757123	0.758644	0.757123	0.758644
5	GradientBoost	0.749888	0.766395	0.770169	0.766395	0.770169

Baseline Model: 25% 421a, 75% non 421a

Production Model

GridSearchCV Best Parameters

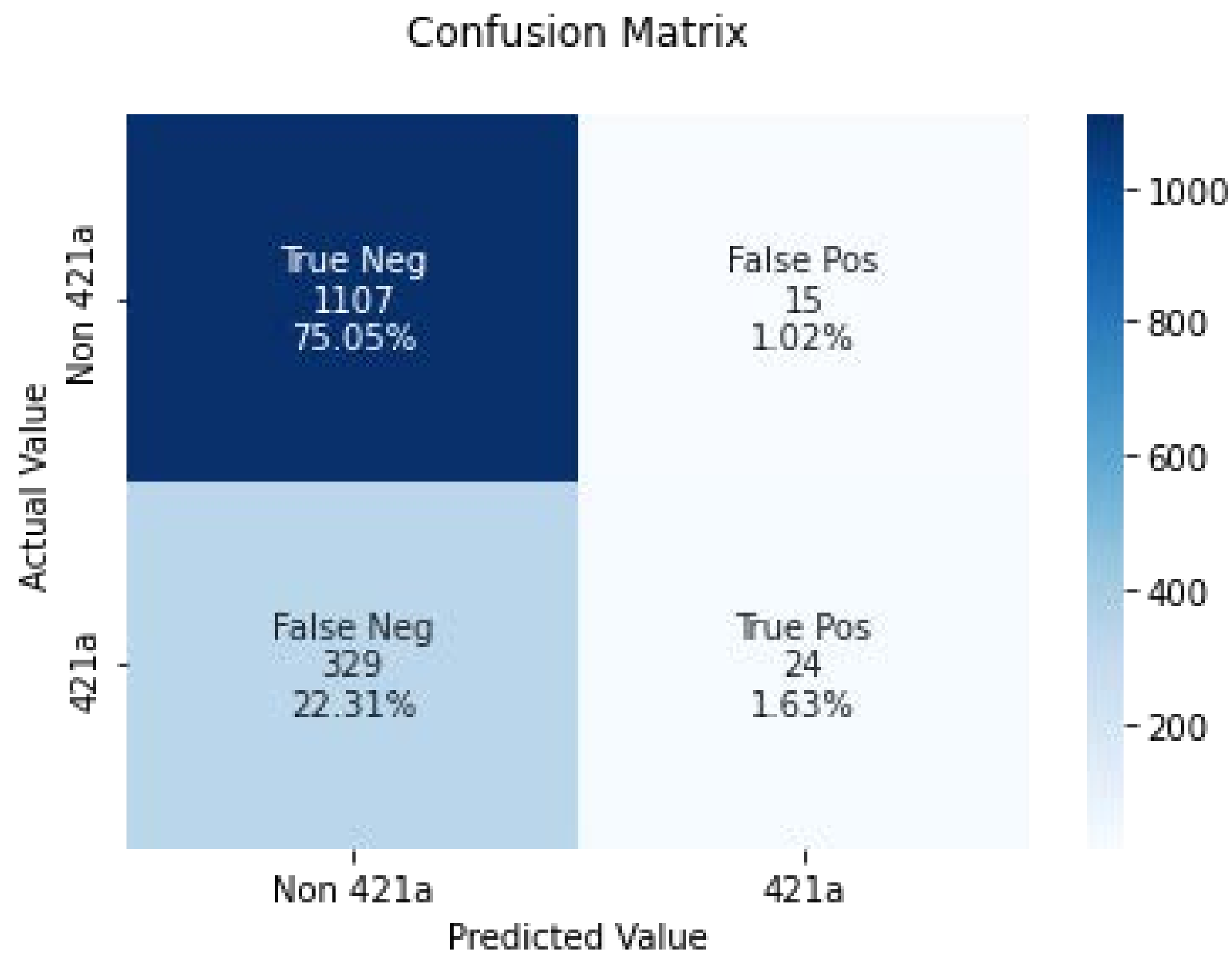
learning_rate: 0.1
loss: exponential
max_depth: 3
min_samples_leaf: 1
min_samples_split: 2
n_estimators: 100

Model Performance

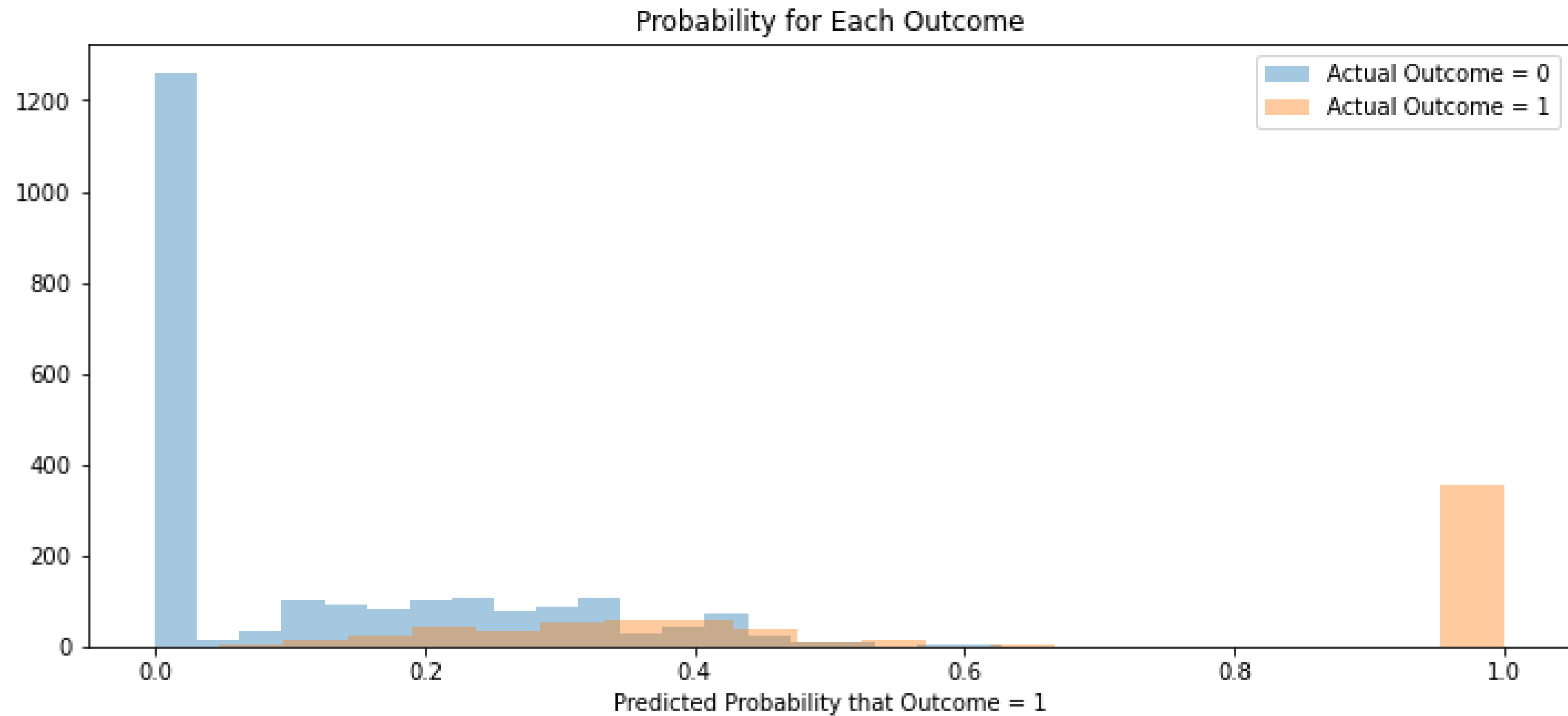
Cross Val Score: 0.7503
GradientBoost Train Score: 0.7626
GradientBoost Test Score: 0.7668

Accuracy: .7742
Sensitivity: .1473
Specificity: .9714
Precision: .6190

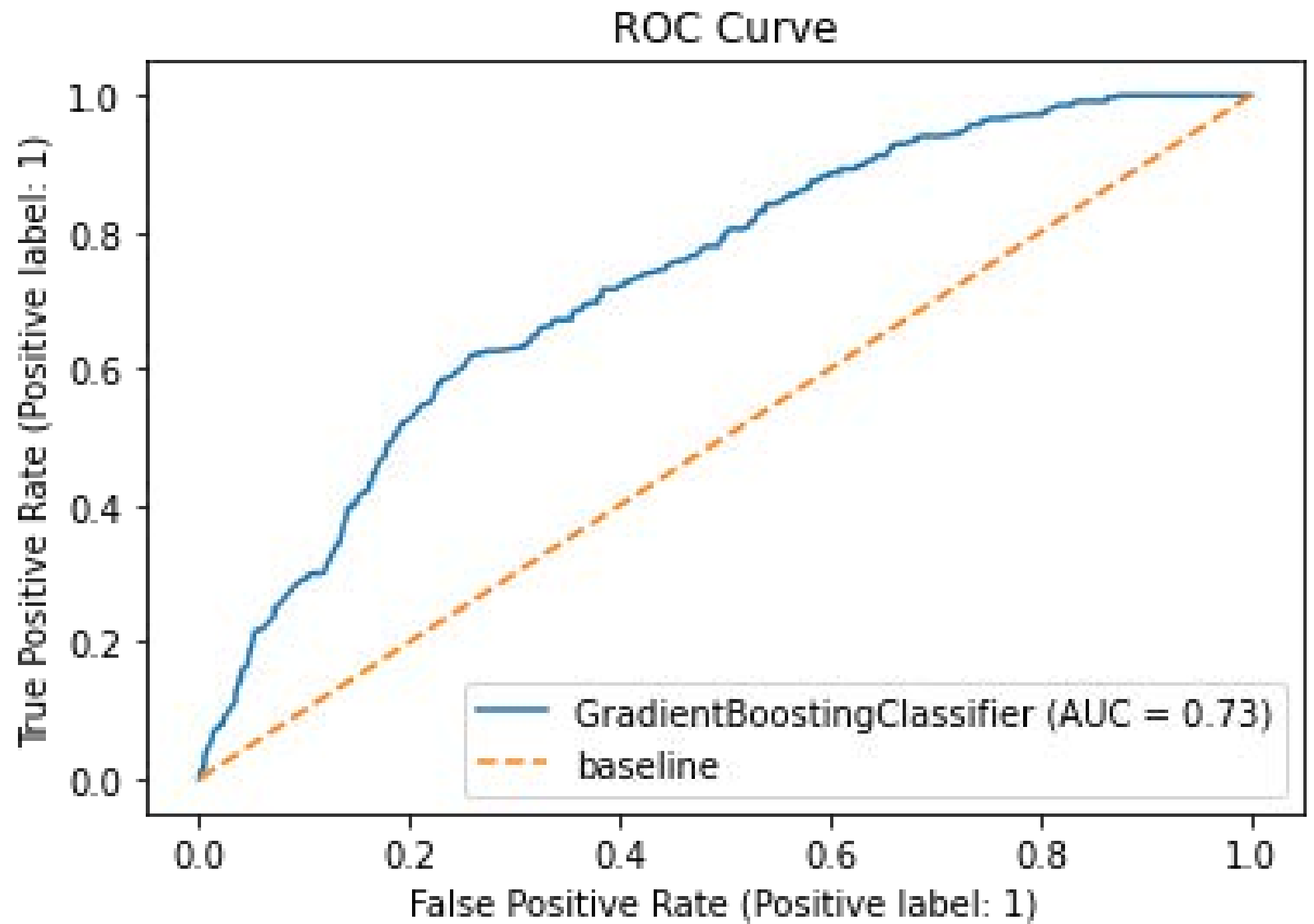
Production Model



Production Model



Production Model





Conclusions and Next Steps

While there were some low level correlations with neighborhood characteristics, no single feature displayed a strong enough relationship to make predictive statements about the likelihood of a development receiving a 421a tax abatement.

This could be due to an insufficient amount of data or due to the model not capturing complex elements related to development decisions. As is, the model did not prove there are any features that influence the distribution of 421a incentives in a biased nature.

Further research could be done to compare 421a to other tax incentive programs or isolate specific periods of 421a related policy.