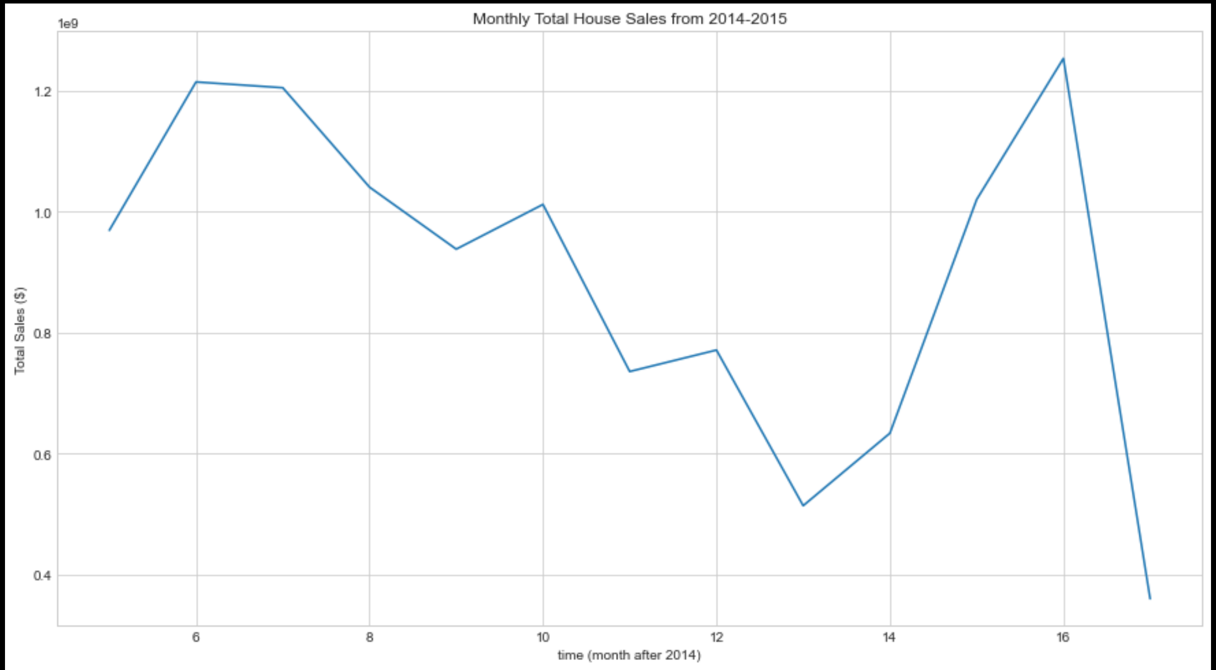
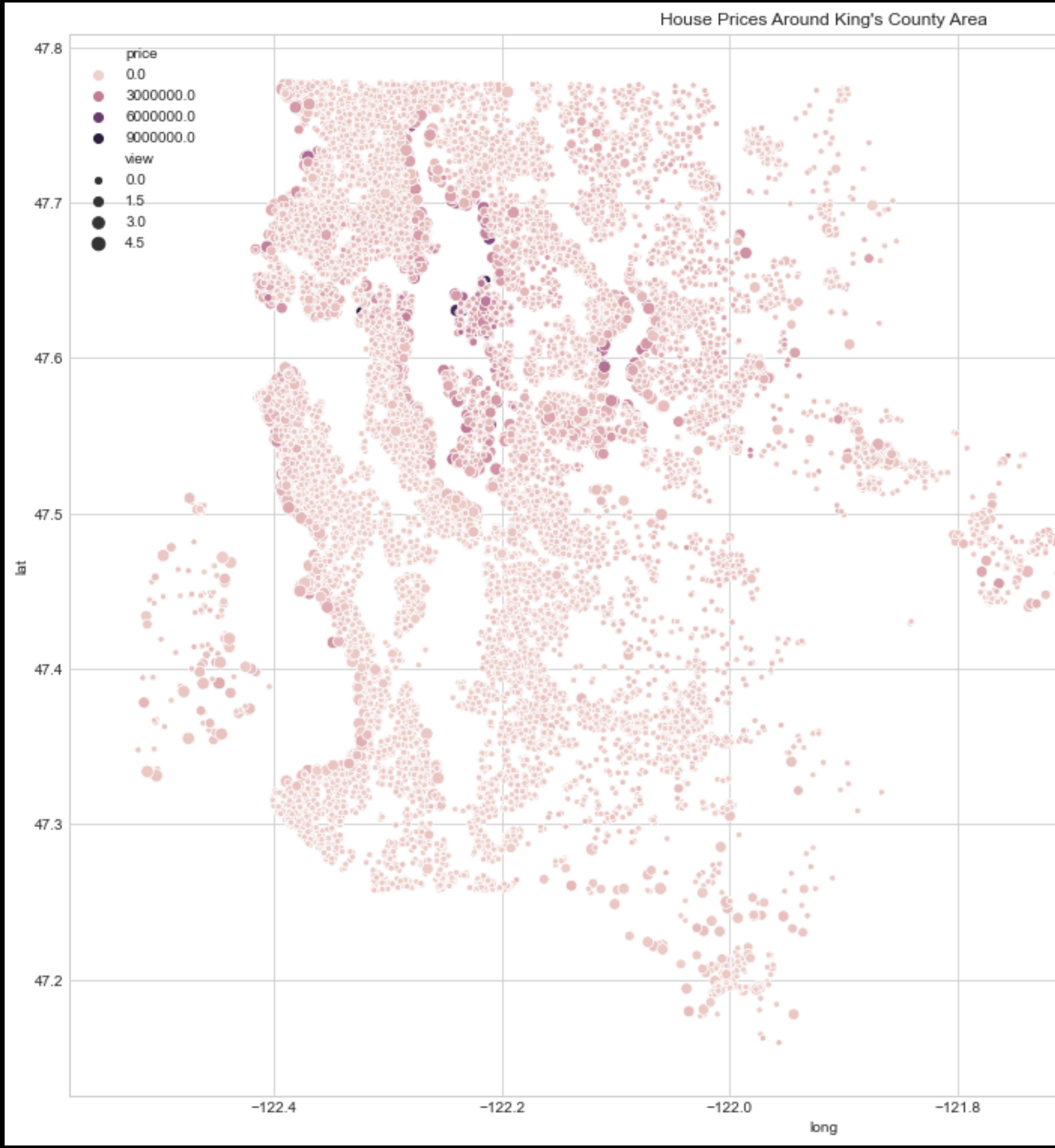
# How to hack house prices

Sung Bae

# Introduction




- House sale is a huge even during recessions (around $1B each month)
- House prices differ depending on various factors (ex. location)



# Question 1

What factors affect the house prices the most in most interpretable and reasonable way?

# Model

1. Priority: interpretability
2. Reasonable predictors
3. May not result in highest $r^2$ value

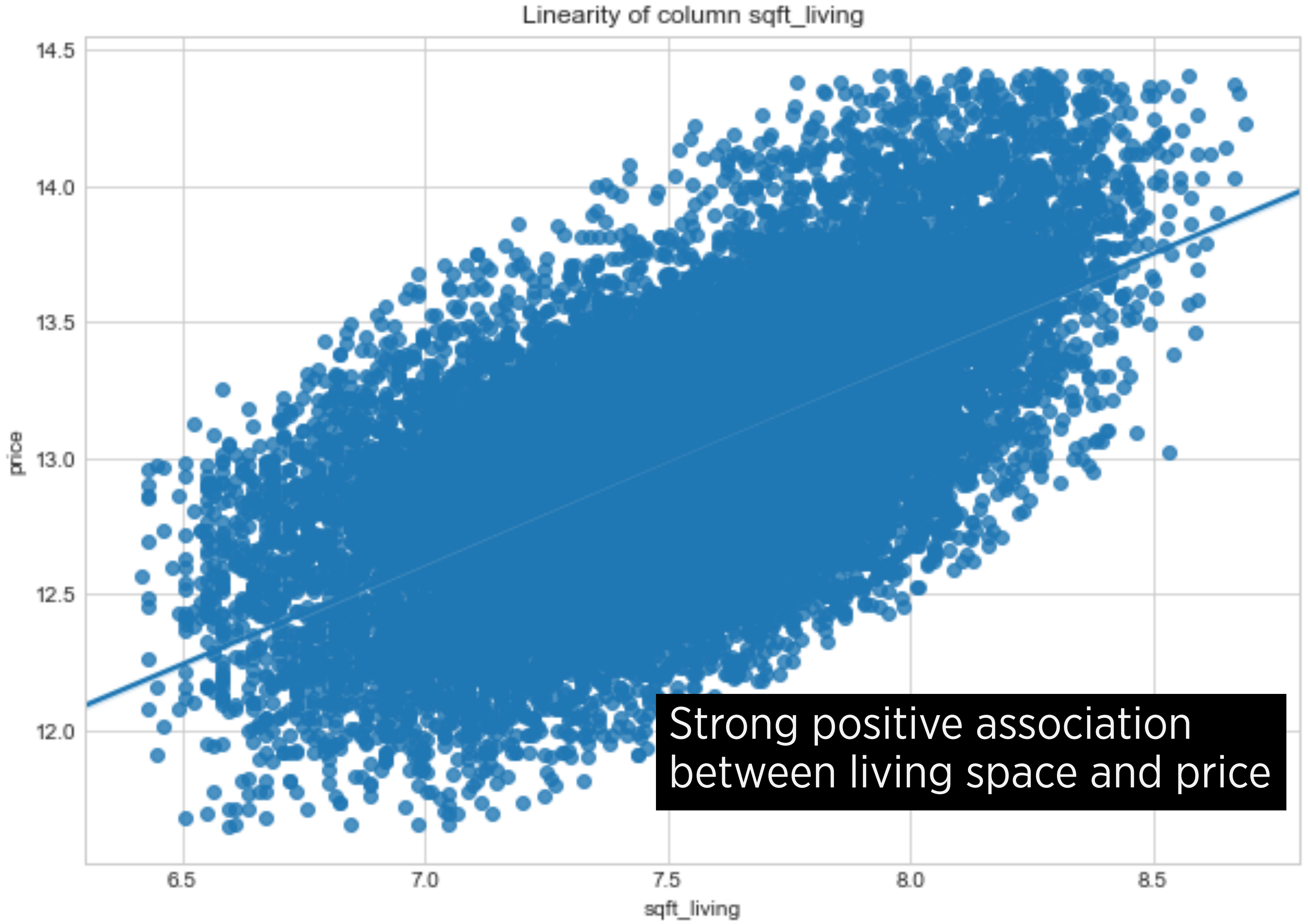
# Question 1: Factors that affect house prices

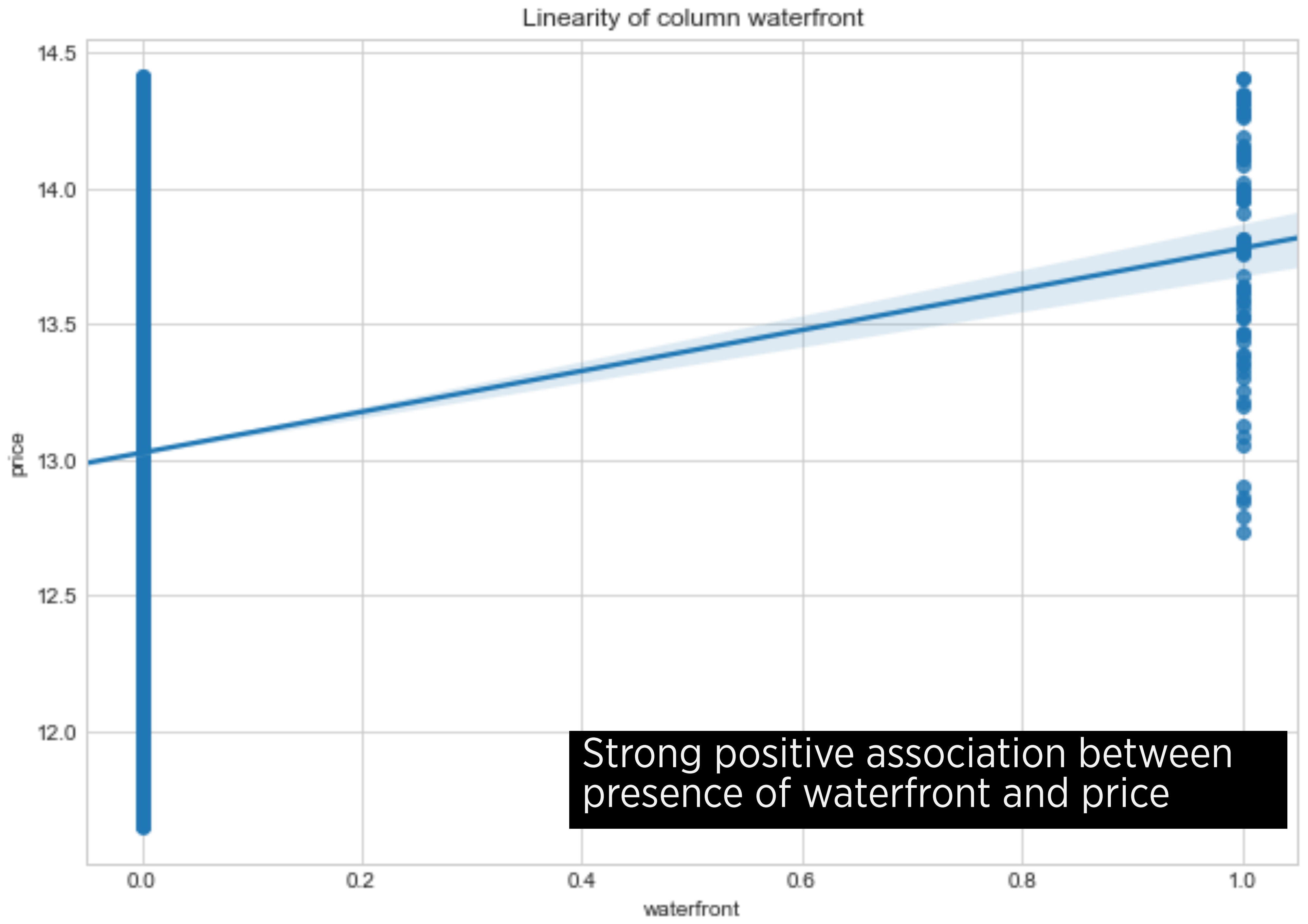
Positive effectors:

1. living area = more space means higher price
2. waterfront = having waterfront increases the value of the price
3. grade x bathroom = having great bathrooms count!
4. higher latitude = usually results in higher price

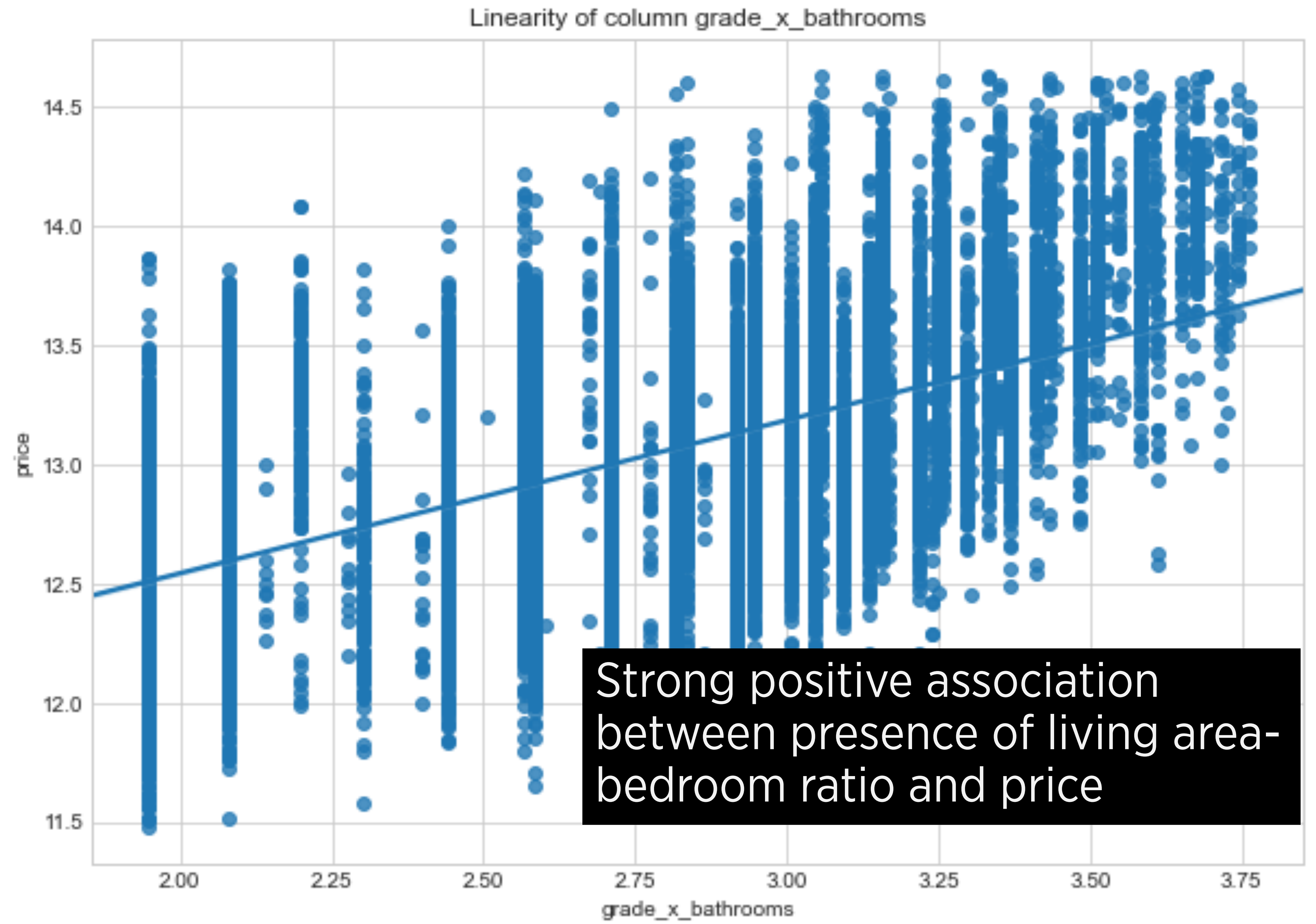
Negative effectors:

1. bath and bed= having too many of them decreases the price
2. longitude = higher longitude results in lower price


Linearity of column sqft_living
price
sqft_living
14.5
14.0
13.5
13.0
12.5
12.0
6.5
7.0
7.5
8.0
8.5
Strong positive association between living space and price




Strong positive association between presence of waterfront and price




Strong positive association between presence of living area-bedroom ratio and price

# Question 2

So what can be done to maximize house price by the homeowners?

# Actions that can be done:

| *Increase Living Area* | *grade x bathrooms* | *Make some waterfront* |
| --- | --- | --- |
| - second strongest factor<br>- Shows that people love having bigger independent open spaces | - Shows how important it is to have great quality bathrooms<br>- Renovating bathrooms can be key to increasing your house value! | - The strongest factor<br>- Shows people love nature<br>- construct or install some sort of water fountains or pond that can be seen from the house |

# Actions that can be done:

*Some Serious Renovation!*

### *Increase Living Area*

- second strongest factor
- Shows that people love having bigger independent open spaces

### *grade x bathrooms*

- Shows how important it is to have great quality bathrooms
- Renovating bathrooms can be key to increasing your house value!

### *Make some waterfront*

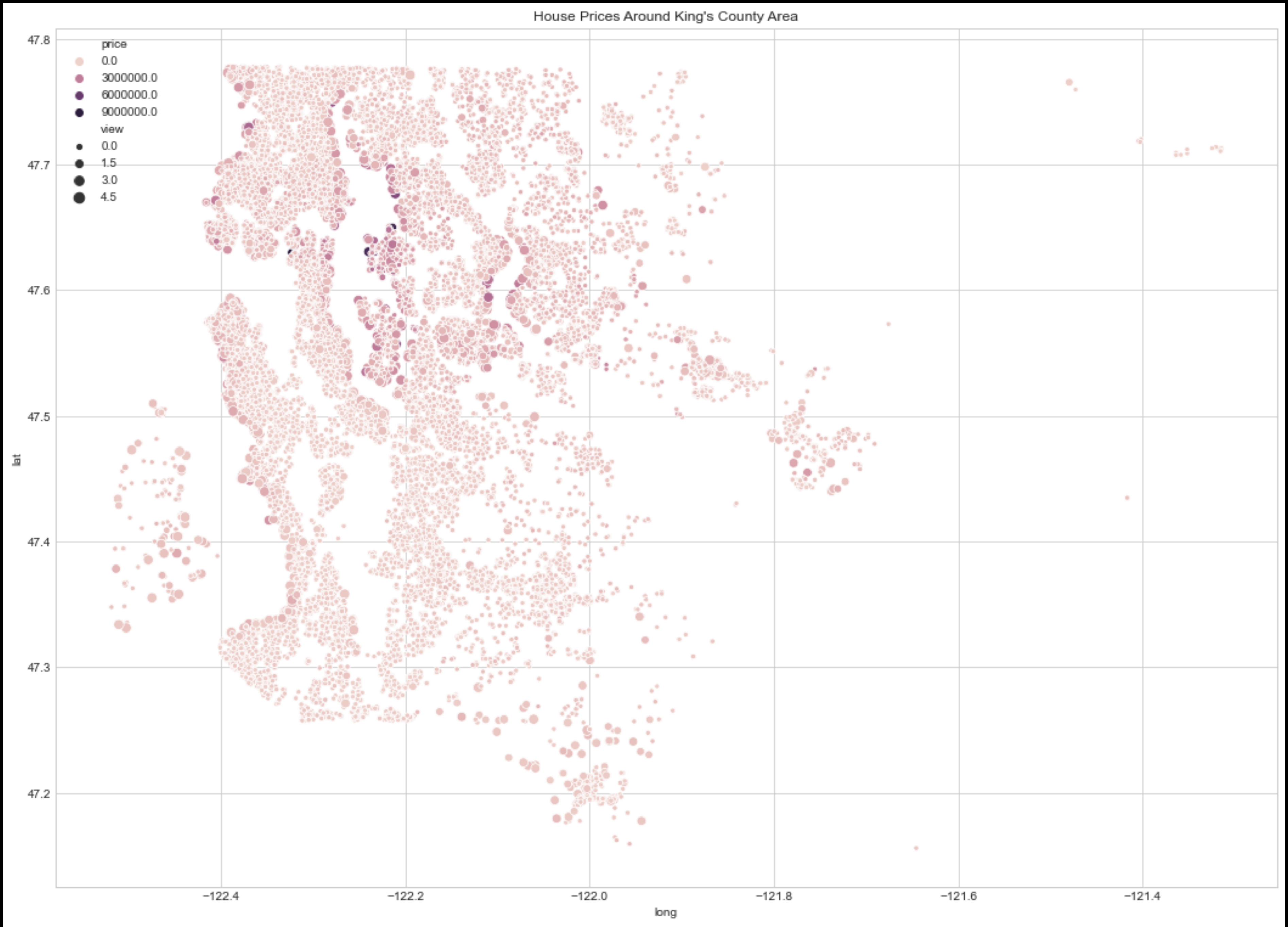
- The strongest factor
- Shows people love nature
- construct or install some sort of water fountains or pond that can be seen from the house

# Conclusion

- Model is limited
- However it can give us a good idea of what factors we can control and change to change the house price
  - Actionable changes
    - Renovate to
      - Increase open space
      - Waterfront presence
      - Better quality bathrooms
  - What NOT to do
    - increase number of bathrooms and bedrooms in total

Thank you for listening

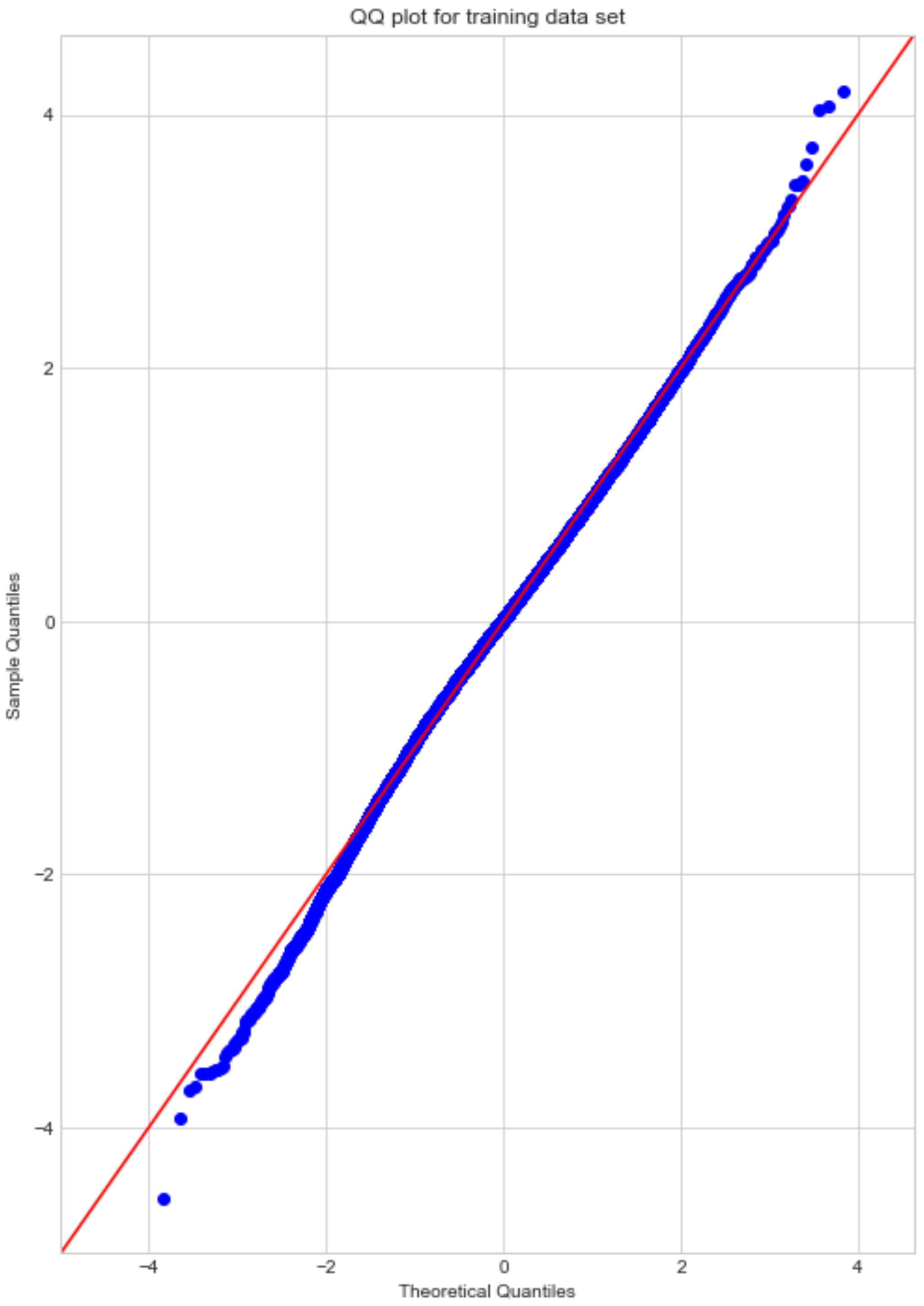
# Appendix

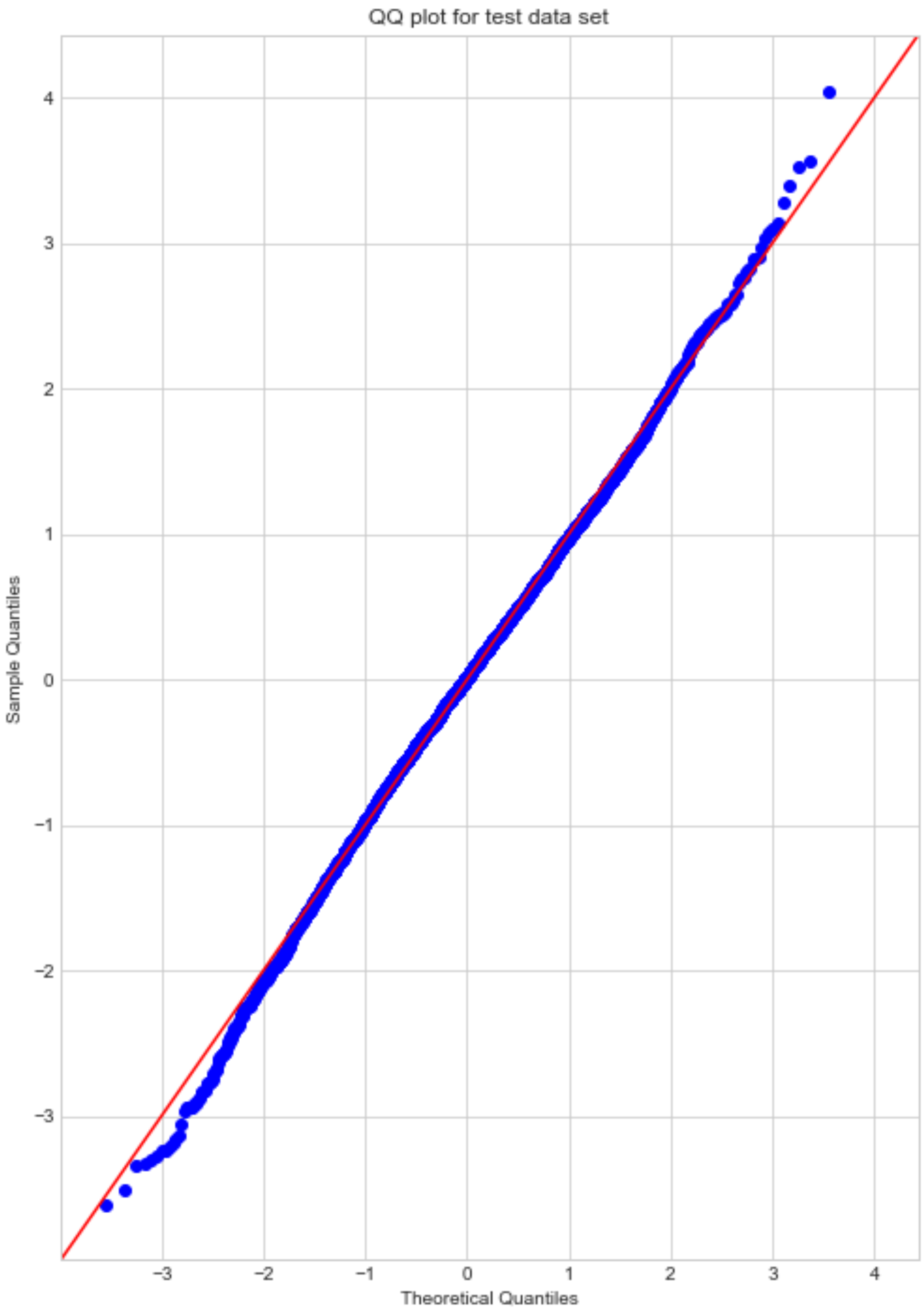

House Prices Around King's County Area
price
0.0
3000000.0
6000000.0
9000000.0
view
0.0
1.5
3.0
4.5
47.8
47.7
47.6
47.5
47.4
47.3
47.2
lat
−122.4
−122.2
−122.0
−121.8
−121.6
−121.4
long

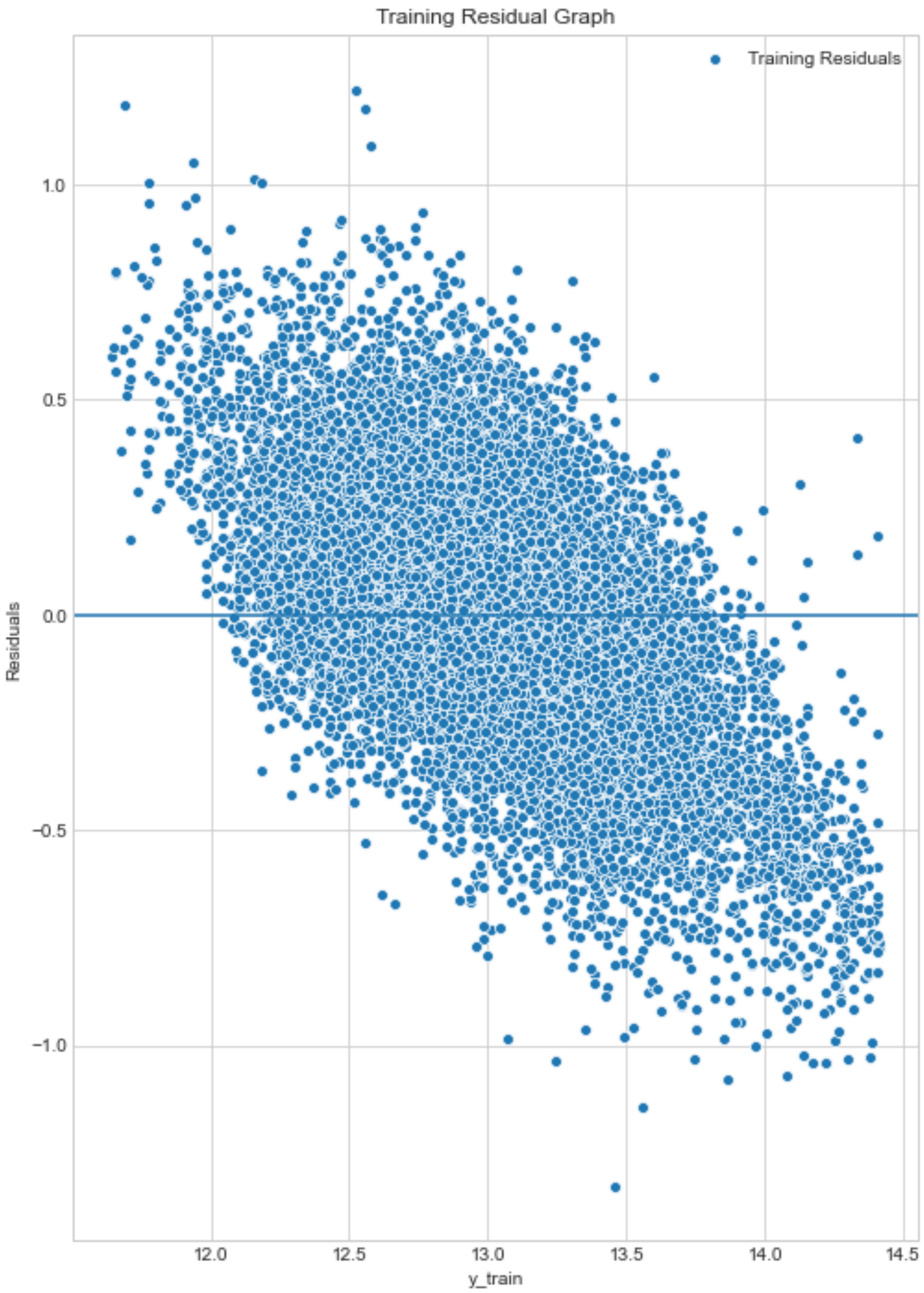
| | | | |
|---|---|---|---|
| **Dep. Variable:** | price | **R-squared:** | 0.653 |
| **Model:** | OLS | **Adj. R-squared:** | 0.653 |
| **Method:** | Least Squares | **F-statistic:** | 3230. |
| **Date:** | Thu, 17 Sep 2020 | **Prob (F-statistic):** | 0.00 |
| **Time:** | 18:43:41 | **Log-Likelihood:** | -2665.6 |
| **No. Observations:** | 15459 | **AIC:** | 5351. |
| **Df Residuals:** | 15449 | **BIC:** | 5428. |
| **Df Model:** | 9 | | |
| **Covariance Type:** | nonrobust | | |

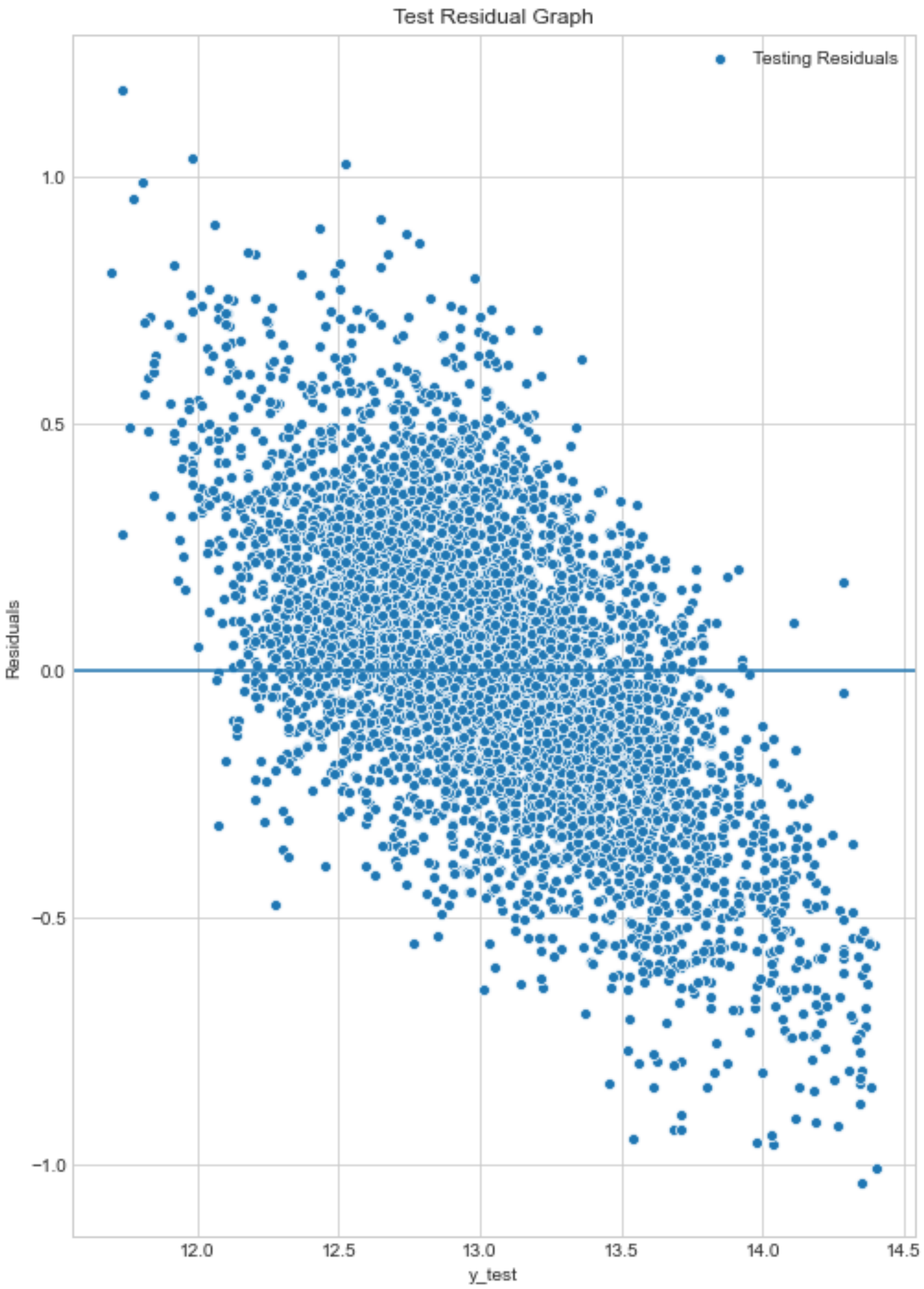
| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| **Intercept** | 7.6598 | 0.058 | 132.387 | 0.000 | 7.546 | 7.773 |
| **sqft_living** | 0.7205 | 0.010 | 69.292 | 0.000 | 0.700 | 0.741 |
| **bath_and_bed** | -0.5359 | 0.021 | -25.865 | 0.000 | -0.576 | -0.495 |
| **grade_x_bathrooms** | 0.3316 | 0.011 | 30.751 | 0.000 | 0.310 | 0.353 |
| **lat** | 0.2097 | 0.002 | 90.303 | 0.000 | 0.205 | 0.214 |
| **long** | -0.0329 | 0.003 | -12.347 | 0.000 | -0.038 | -0.028 |
| **waterfront_10** | 0.6248 | 0.035 | 18.017 | 0.000 | 0.557 | 0.693 |
| **yr_renovated_True** | 0.1501 | 0.013 | 11.535 | 0.000 | 0.125 | 0.176 |
| **grade_5** | -0.0957 | 0.053 | -1.811 | 0.070 | -0.199 | 0.008 |
| **grade_6** | -0.0075 | 0.009 | -0.819 | 0.413 | -0.026 | 0.010 |

| | | | |
|---|---|---|---|
| **Omnibus:** | 237.270 | **Durbin-Watson:** | 1.988 |
| **Prob(Omnibus):** | 0.000 | **Jarque-Bera (JB):** | 294.416 |
| **Skew:** | 0.231 | **Prob(JB):** | 1.17e-64 |
| **Kurtosis:** | 3.494 | **Cond. No.** | 212. |


QQ plot for training data set
Sample Quantiles
Theoretical Quantiles
4
2
0
−2
−4
−4
−2
0
2
4


QQ plot for test data set
Sample Quantiles
Theoretical Quantiles
4
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
4


Training Residual Graph
Training Residuals
Residuals
y_train
1.0
0.5
0.0
−0.5
−1.0
12.0
12.5
13.0
13.5
14.0
14.5


Test Residual Graph
Testing Residuals
Residuals
y_test
1.0
0.5
0.0
−0.5
−1.0
12.0
12.5
13.0
13.5
14.0
14.5