# House Price Regression Modelling Project

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# Summary

The purpose of this regression model is to predict the house prices in King County by analysing the King County House Sales dataset.

# Outline

- Business Problem
- Cleaning the Data
- Exploratory Data Analysis
- Models
- Conclusions

# Business Problem

How can we predict the house price sales in King County?

In order to solve this problem, I intended to answer the below questions:

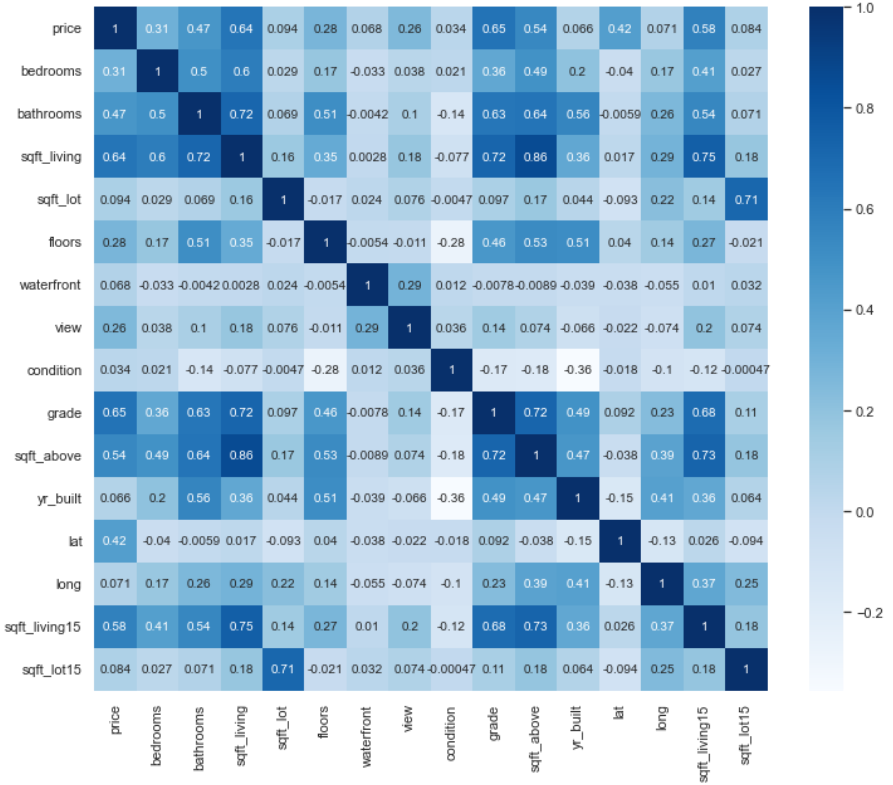
1. Does location impact sale price?
2. Does the size of the house impact sale price?
3. Does quality of the house impact sale price?

# Cleaning the Data

- Dropped unnecessary data
- Replaced or removed null values
- Narrowed data to only included houses with <6 bedrooms
- Using the empirical formula I removed outliers
- Addressed multicollinearity
- Split data set between continuous and categorical data
- Binned Grade into Low, Average and High

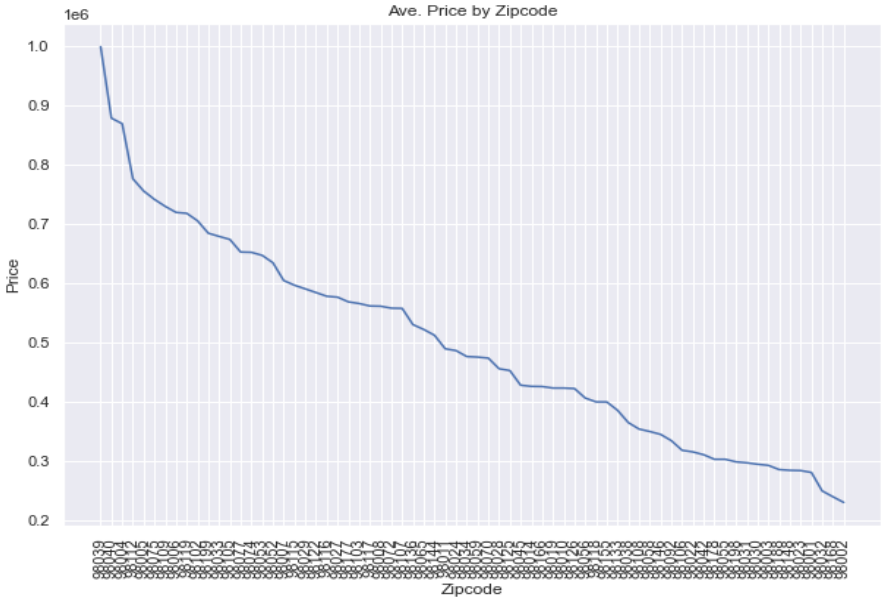
# Exploratory Data Analysis

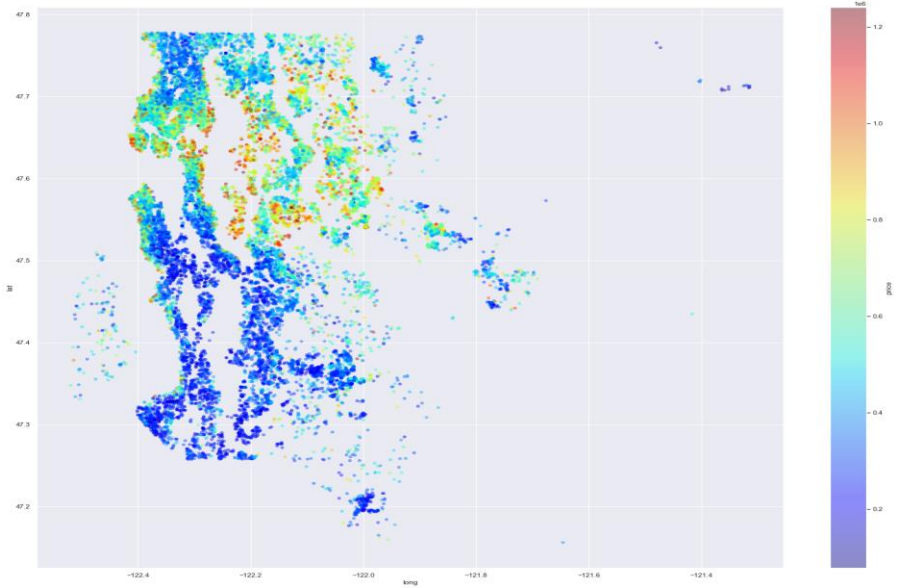
- Key Features include:
  - Bathrooms
  - Square Foot living space
  - Grade
  - Latitude
  - Square Foot Above
  - Square Foot Living 15 (neighbors)
- Notes:
  - Zip code excluded as data-type is a string
  - Latitude correlates with price more than Longitude



# Exploratory Data Analysis

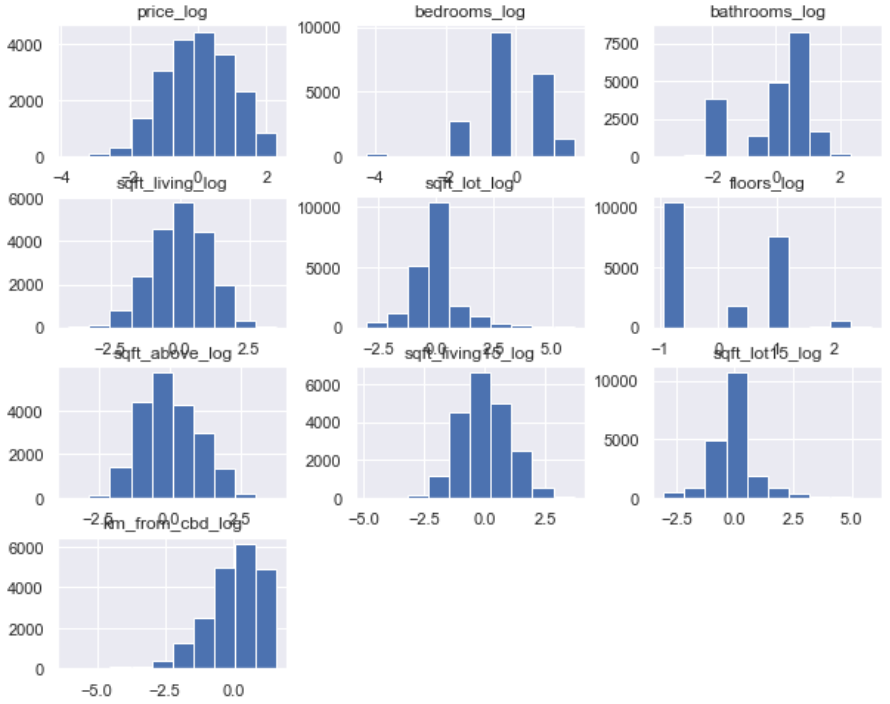
- Created price vs zip code graph to explore price distribution across zip codes and then plotted to a heatmap.
- Using these visualization I created  a new variable – Distance from CBD



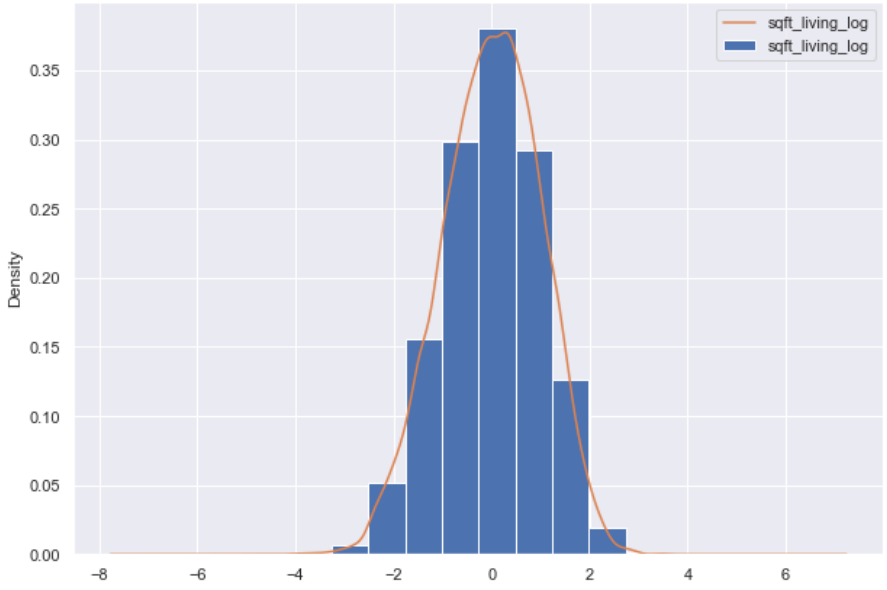
# Exploratory Data Analysis

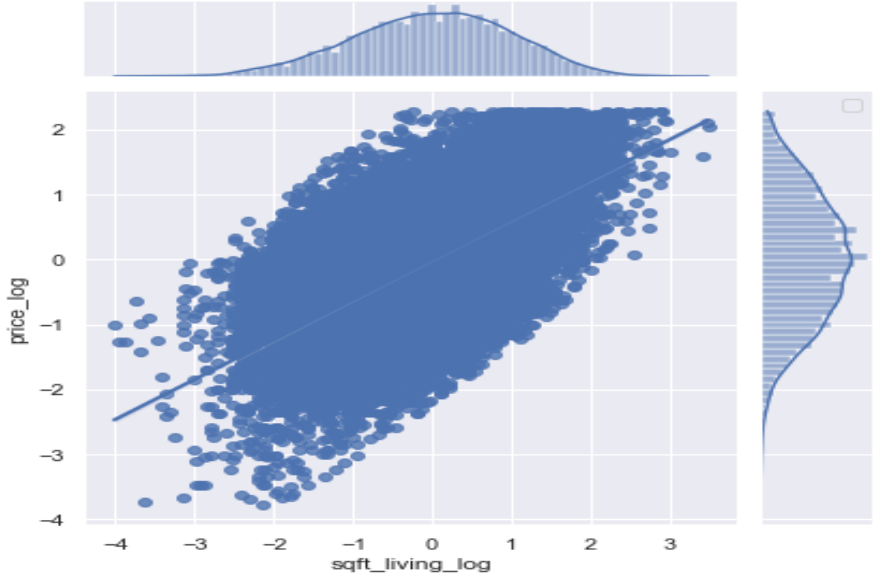
- Used mean normalization to standardise the data
- Sqft living, sqft lot, sqft above, sqft living 15, sqft lot 15 appear good
- Km from CBD is negatively skewed



# Exploratory Data Analysis

- Used KDE plot and joint plot to explore data



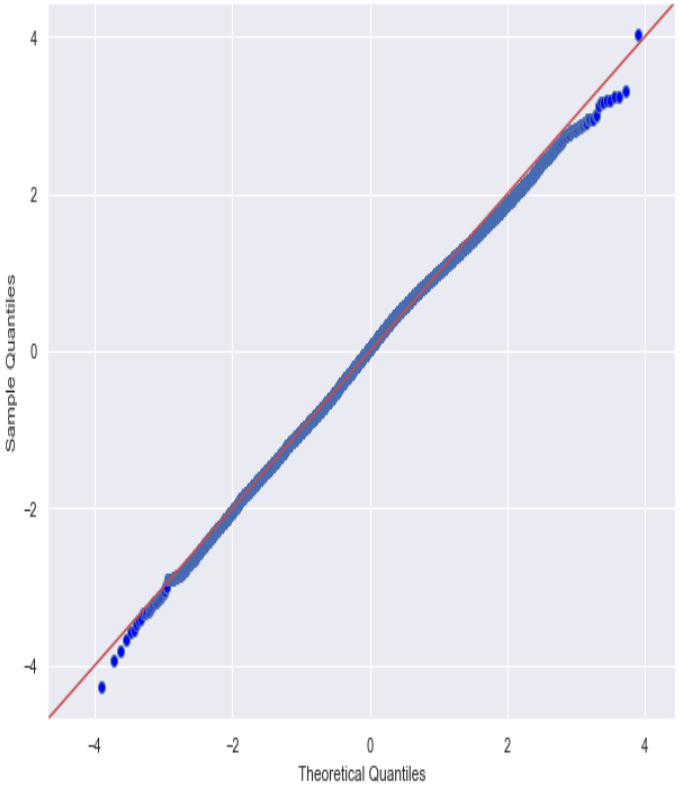
# Model 1

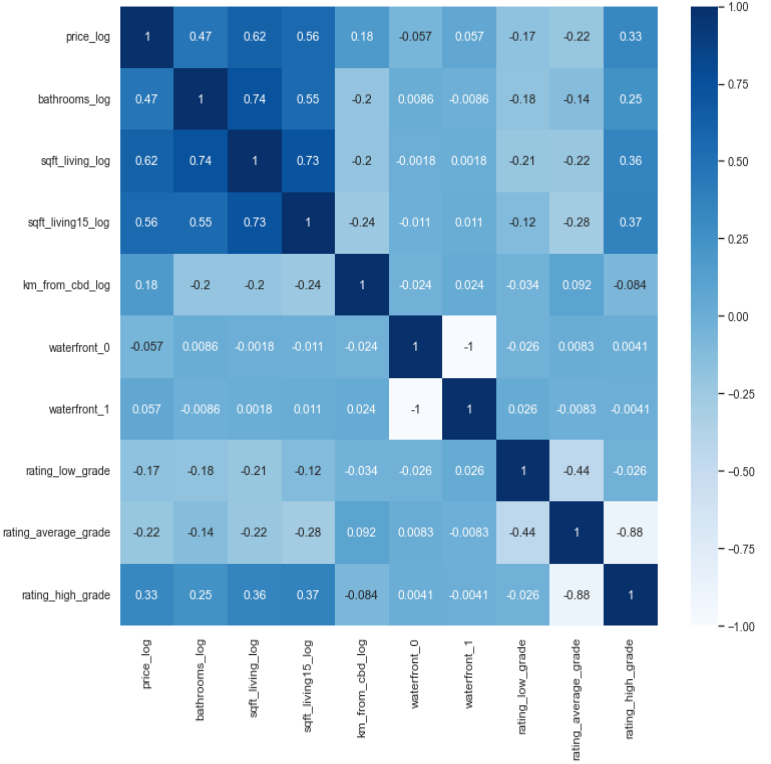
OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | price_log | R-squared: | 0.527 |
| Model: | OLS | Adj. R-squared: | 0.527 |
| Method: | Least Squares | F-statistic: | 3244. |
| Date: | Fri, 03 Jun 2022 | Prob (F-statistic): | 0.00 |
| Time: | 10:23:16 | Log-Likelihood: | -21322. |
| No. Observations: | 20407 | AIC: | 4.266e+04 |
| Df Residuals: | 20399 | BIC: | 4.272e+04 |
| Df Model: | 7 | | |
| Covariance Type: | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | 0.0273 | 0.012 | 2.268 | 0.023 | 0.004 | 0.051 |
| bathrooms_log | 0.0632 | 0.007 | 8.810 | 0.000 | 0.049 | 0.077 |
| sqft_living_log | 0.3877 | 0.009 | 43.476 | 0.000 | 0.370 | 0.405 |
| sqft_living15_log | 0.2796 | 0.007 | 38.529 | 0.000 | 0.265 | 0.294 |
| km_from_cbd_log | 0.3396 | 0.005 | 67.982 | 0.000 | 0.330 | 0.349 |
| waterfront_1 | 0.8624 | 0.089 | 9.685 | 0.000 | 0.688 | 1.037 |
| rating_low_grade | -0.3423 | 0.034 | -10.215 | 0.000 | -0.408 | -0.277 |
| rating_average_grade | -0.0493 | 0.013 | -3.929 | 0.000 | -0.074 | -0.025 |
| rating_high_grade | 0.4189 | 0.021 | 19.581 | 0.000 | 0.377 | 0.461 |

| | | | |
|---|---|---|---|
| Omnibus: | 92.698 | Durbin-Watson: | 1.990 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 90.193 |
| Skew: | -0.144 | Prob(JB): | 2.60e-20 |
| Kurtosis: | 2.848 | Cond. No. | 7.34e+15 |



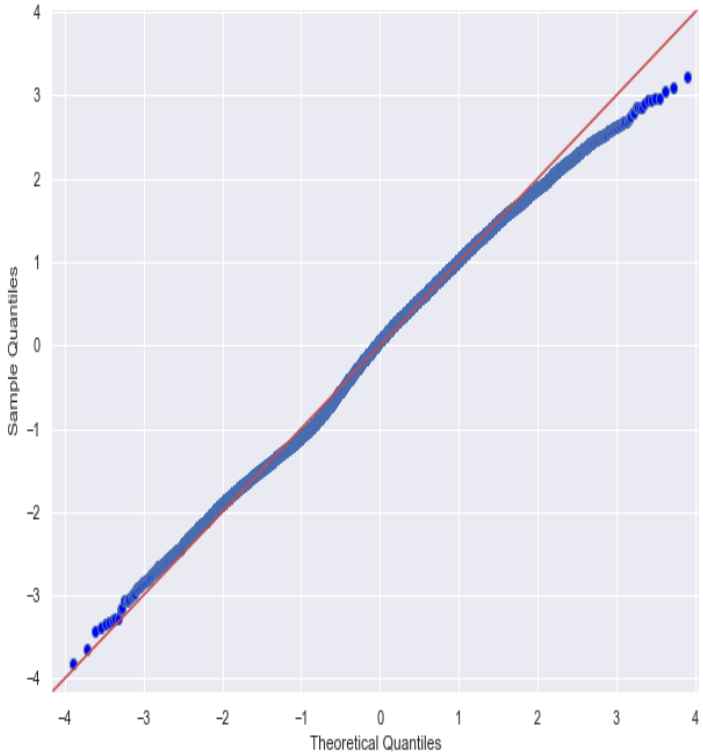
# Model 2

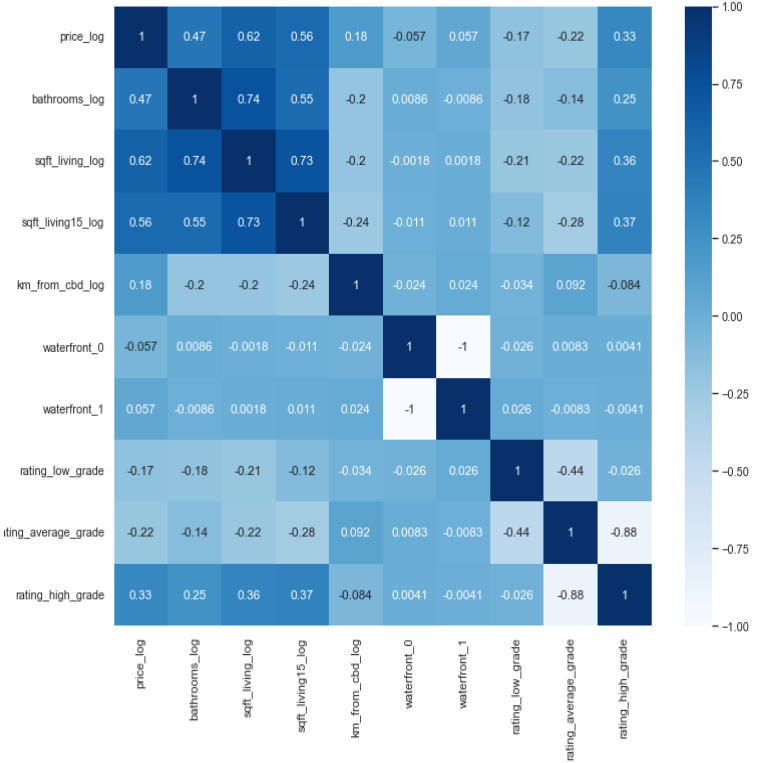
OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | price_log | R-squared: | 0.413 |
| Model: | OLS | Adj. R-squared: | 0.413 |
| Method: | Least Squares | F-statistic: | 3592. |
| Date: | Fri, 03 Jun 2022 | Prob (F-statistic): | 0.00 |
| Time: | 10:23:18 | Log-Likelihood: | -23516. |
| No. Observations: | 20407 | AIC: | 4.704e+04 |
| Df Residuals: | 20402 | BIC: | 4.708e+04 |
| Df Model: | 4 | | |
| Covariance Type: | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -0.0235 | 0.006 | -4.259 | 0.000 | -0.034 | -0.013 |
| bathrooms_log | 0.0280 | 0.008 | 3.521 | 0.000 | 0.012 | 0.044 |
| sqft_living_log | 0.4062 | 0.010 | 41.272 | 0.000 | 0.387 | 0.425 |
| sqft_living15_log | 0.2075 | 0.008 | 25.980 | 0.000 | 0.192 | 0.223 |
| rating_high_grade | 0.4723 | 0.027 | 17.611 | 0.000 | 0.420 | 0.525 |

| | | | |
|---|---|---|---|
| Omnibus: | 305.924 | Durbin-Watson: | 1.969 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 187.564 |
| Skew: | -0.072 | Prob(JB): | 1.87e-41 |
| Kurtosis: | 2.553 | Cond. No. | 7.71 |



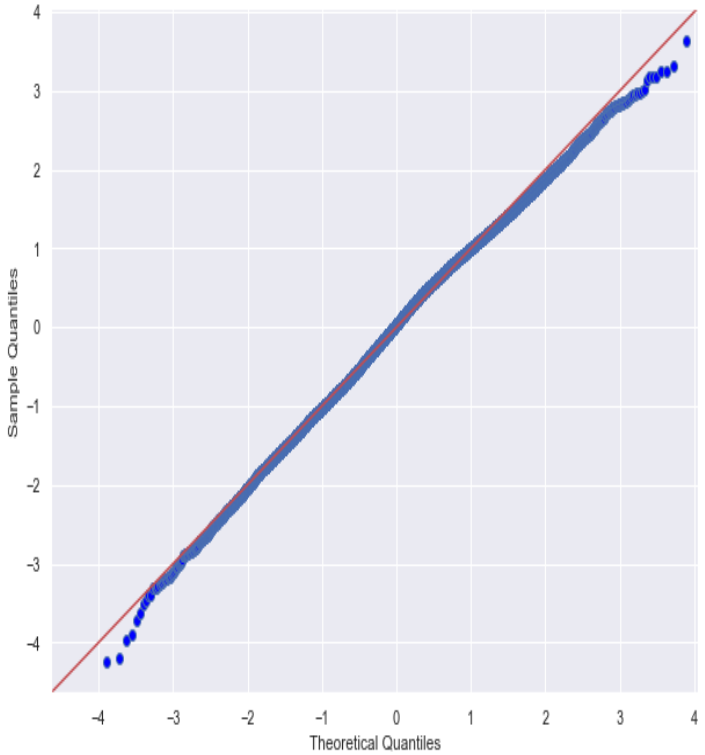
# Model 3

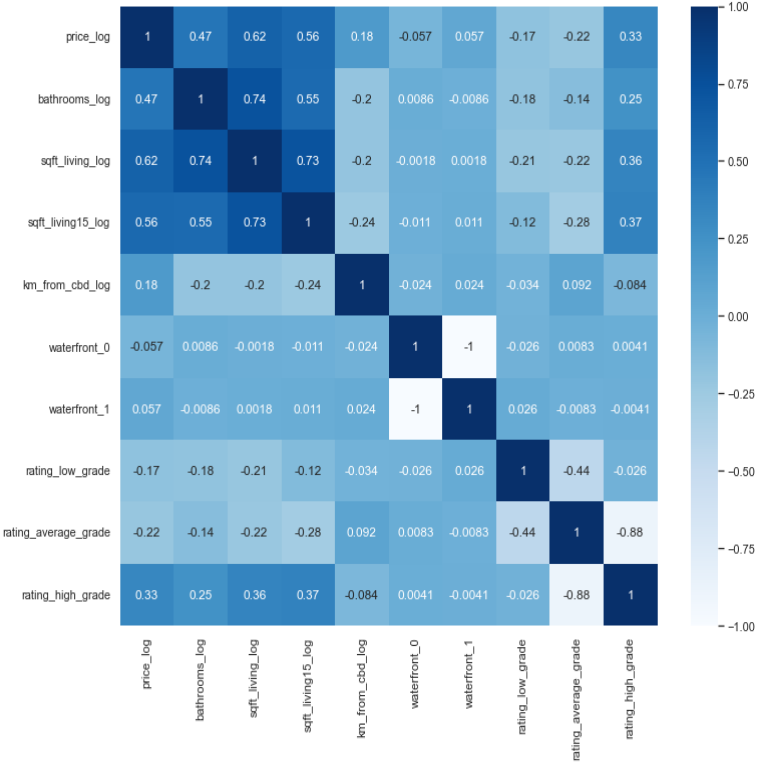
OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | price_log | R-squared: | 0.524 |
| Model: | OLS | Adj. R-squared: | 0.524 |
| Method: | Least Squares | F-statistic: | 4485. |
| Date: | Fri, 03 Jun 2022 | Prob (F-statistic): | 0.00 |
| Time: | 10:23:18 | Log-Likelihood: | -21390. |
| No. Observations: | 20407 | AIC: | 4.279e+04 |
| Df Residuals: | 20401 | BIC: | 4.284e+04 |
| Df Model: | 5 | | |
| Covariance Type: | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | -0.0229 | 0.005 | -4.593 | 0.000 | -0.033 | -0.013 |
| sqft_living15_log | 0.2791 | 0.007 | 38.373 | 0.000 | 0.265 | 0.293 |
| sqft_living_log | 0.3956 | 0.009 | 44.604 | 0.000 | 0.378 | 0.413 |
| km_from_cbd_log | 0.3434 | 0.005 | 68.749 | 0.000 | 0.334 | 0.353 |
| rating_high_grade | 0.4590 | 0.024 | 18.991 | 0.000 | 0.412 | 0.506 |
| bathrooms_log | 0.0645 | 0.007 | 8.973 | 0.000 | 0.050 | 0.079 |

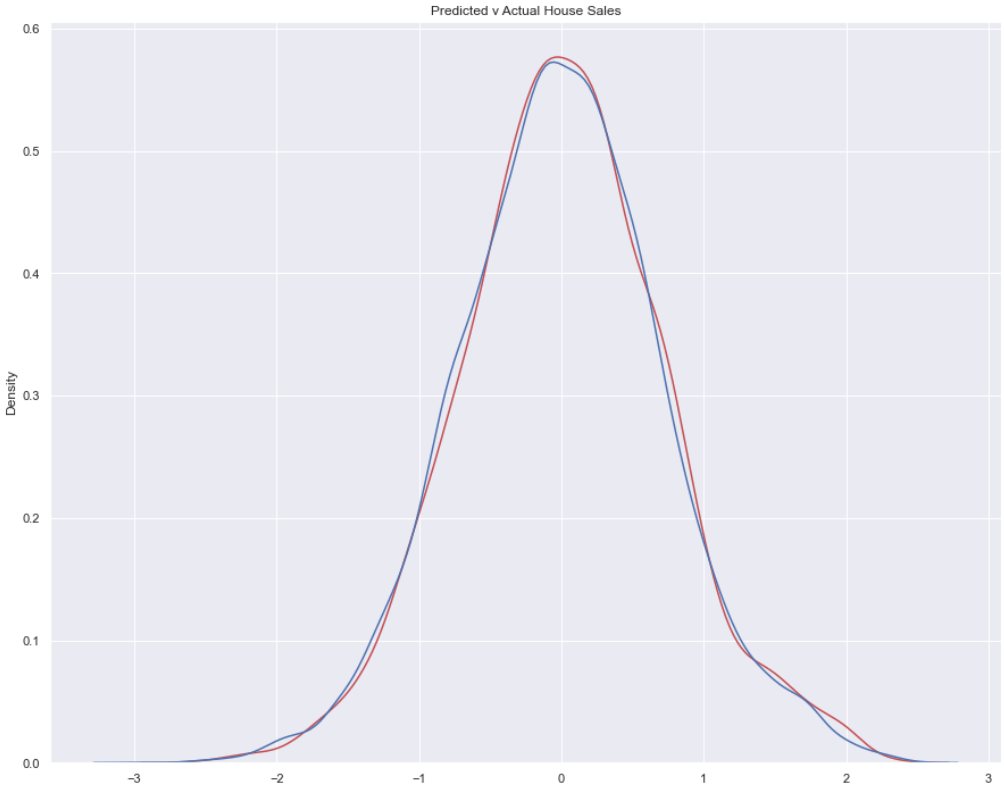
| | | | |
|---|---|---|---|
| Omnibus: | 92.684 | Durbin-Watson: | 1.993 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 91.160 |
| Skew: | -0.149 | Prob(JB): | 1.60e-20 |
| Kurtosis: | 2.863 | Cond. No. | 7.86 |



# Conclusions

- Model 3 provided most reliable result with R^ of 0.524
- Selected features all statistically significant with p-value <0.05
- sqft living15 coef – 0.2791
- sqft living coef – 0.3956
- distance from CBD coef - 0.3434
- bathrooms coef – 0.0645
- high grade rating coef– 0.4590
- These Coef figures mean for unit increase in any one of these variables there was in increase in price by ~0.3 units.



# Thank You!

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