# PROJECT PHASE 2

AN ANALYSIS AND MODELING OF KING'S COUNTY HOME SALES DATASET

BY G-ONE LIMITED

# G-ONE LIMITED MEMBERS

- Nazrah Nyangwara
- Loise Hellen
- Bahati Ndwiga
- Felix Awino
- Robin Mutai
- Stephen Ndirangu
- Daniel Ndirangu

# BUSINESS UNDERSTANDING

- G-One Limited is a real estate agency that helps homeowners buy and/or sell homes. Our client, a family of three has approached us to help them settle on a home that will have the highest resell value.
- Our intention is to help the family get insight into the features that will most contribute to the highest or best sales of the housing units.
- To achieve this, we will analyze the King's County home sales dataset.

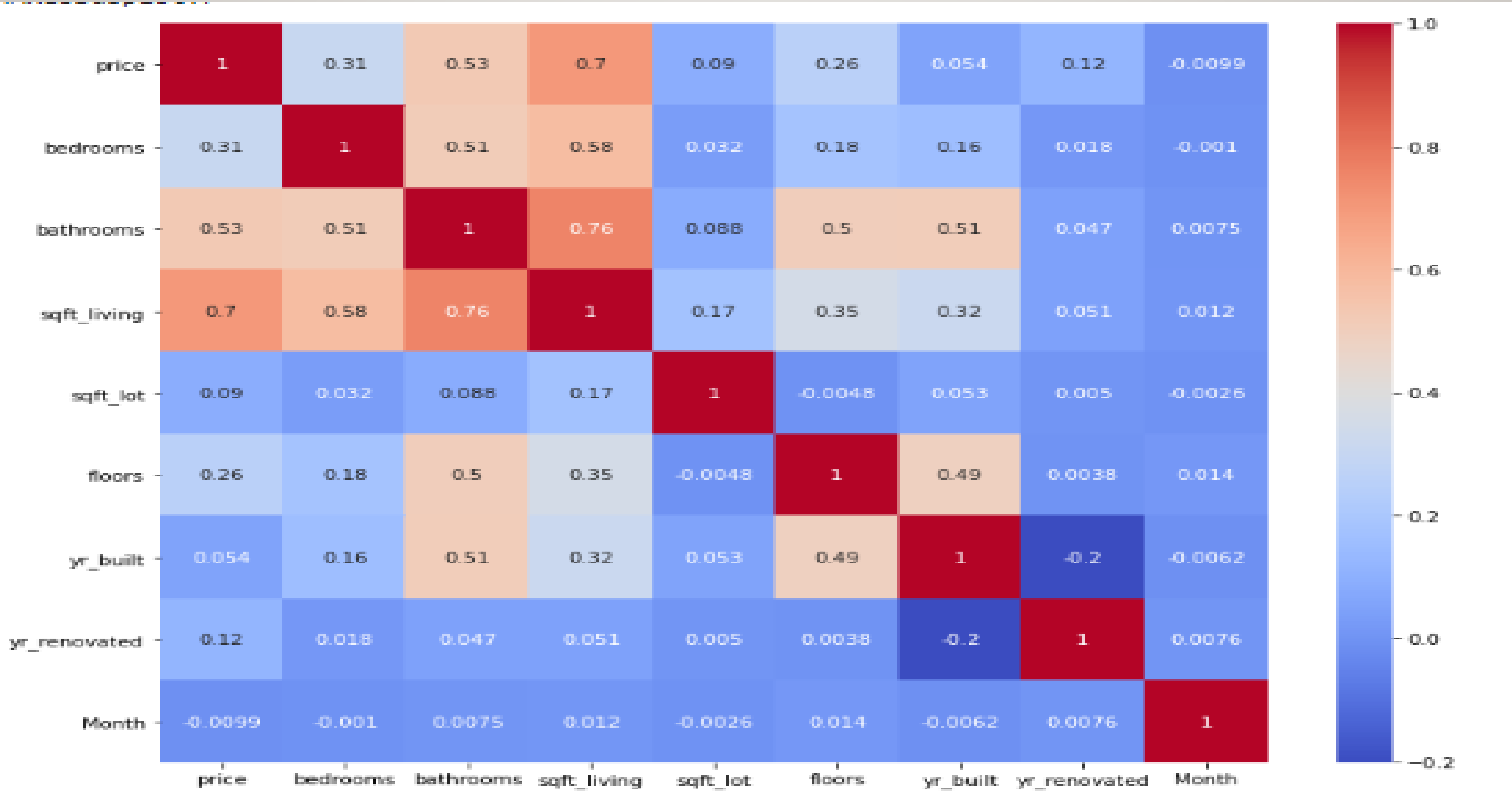
# DATA UNDERSTANDING

- The dataset was obtained from Kings County housing dataset contained in a CSV file named kc_house_data.csv.
- The file contains information on over 21,000 housing units.The data is organized into a table with several columns containing different information about the houses.
- We noted that the data was collected between the time period of 2014 and 2015
- Some of the challenges encountered during data preparation included the presence of missing values, outliers and placeholders.
- We went through data preparation and modeling to come up with our final conclusions for this project

# METHODS USED

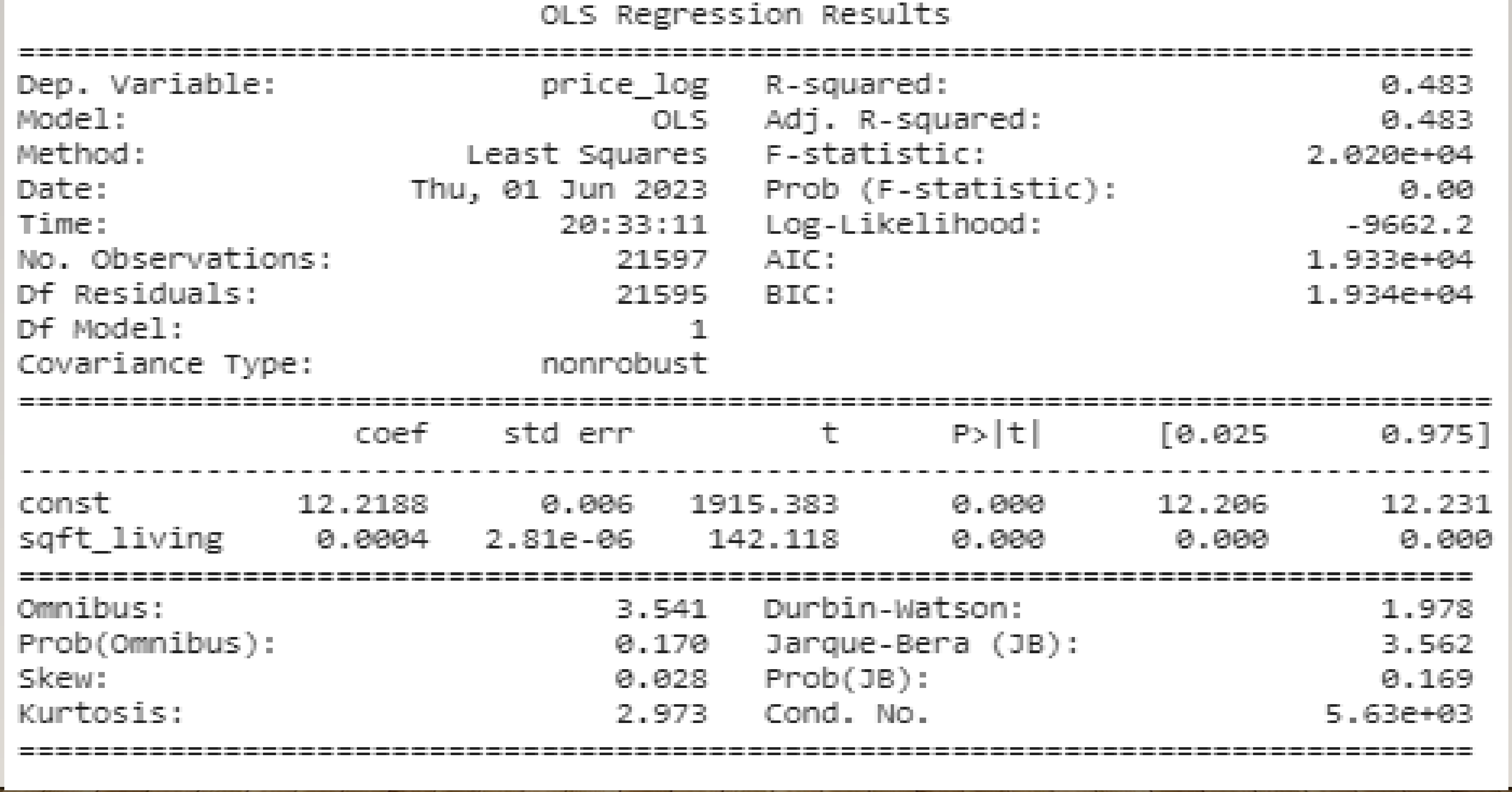
- Data cleaning
  - We filled in missing values, and created some additional columns as necessary
  - Dropping some columns that we deemed not too relevant to the modeling.
- Data Modeling:
  - We created a base model and subsequently added additional variables to come up with our final model
  - Our conclusions and recommendations were based on the final model

# CORRELATION HEAT MAP: PRICE VS FEATURES



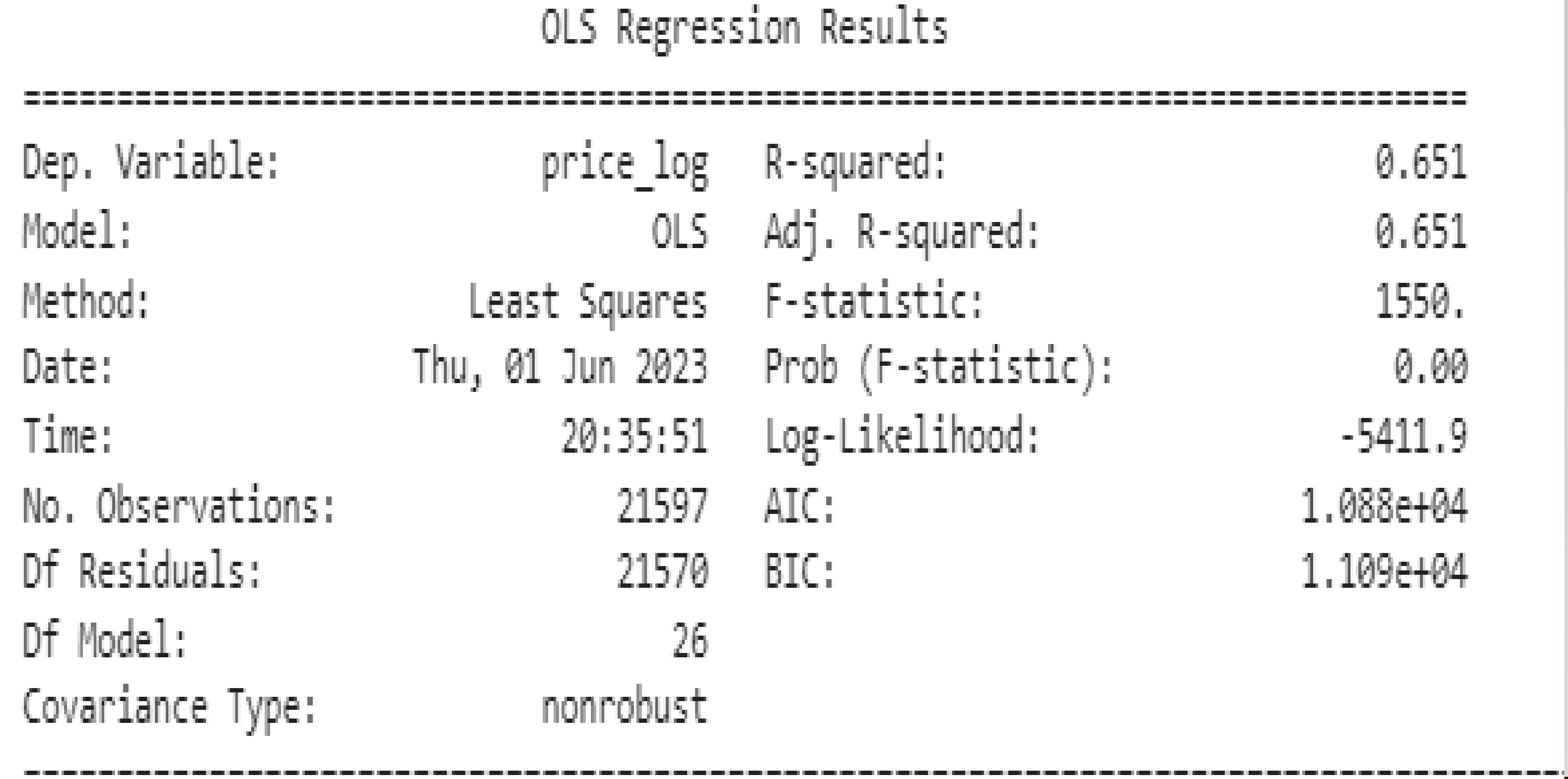
| | price | bedrooms | bathrooms | sqft_living | sqft_lot | floors | yr_built | yr_renovated | Month |
|---|---|---|---|---|---|---|---|---|---|
| price | 1 | 0.31 | 0.53 | 0.7 | 0.09 | 0.26 | 0.054 | 0.12 | -0.0099 |
| bedrooms | 0.31 | 1 | 0.51 | 0.58 | 0.032 | 0.18 | 0.16 | 0.018 | -0.001 |
| bathrooms | 0.53 | 0.51 | 1 | 0.76 | 0.088 | 0.5 | 0.51 | 0.047 | 0.0075 |
| sqft_living | 0.7 | 0.58 | 0.76 | 1 | 0.17 | 0.35 | 0.32 | 0.051 | 0.012 |
| sqft_lot | 0.09 | 0.032 | 0.088 | 0.17 | 1 | -0.0048 | 0.053 | 0.005 | -0.0026 |
| floors | 0.26 | 0.18 | 0.5 | 0.35 | -0.0048 | 1 | 0.49 | 0.0038 | 0.014 |
| yr_built | 0.054 | 0.16 | 0.51 | 0.32 | 0.053 | 0.49 | 1 | -0.2 | -0.0062 |
| yr_renovated | 0.12 | 0.018 | 0.047 | 0.051 | 0.005 | 0.0038 | -0.2 | 1 | 0.0076 |
| Month | -0.0099 | -0.001 | 0.0075 | 0.012 | -0.0026 | 0.014 | -0.0062 | 0.0076 | 1 |

# BASELINE MODEL



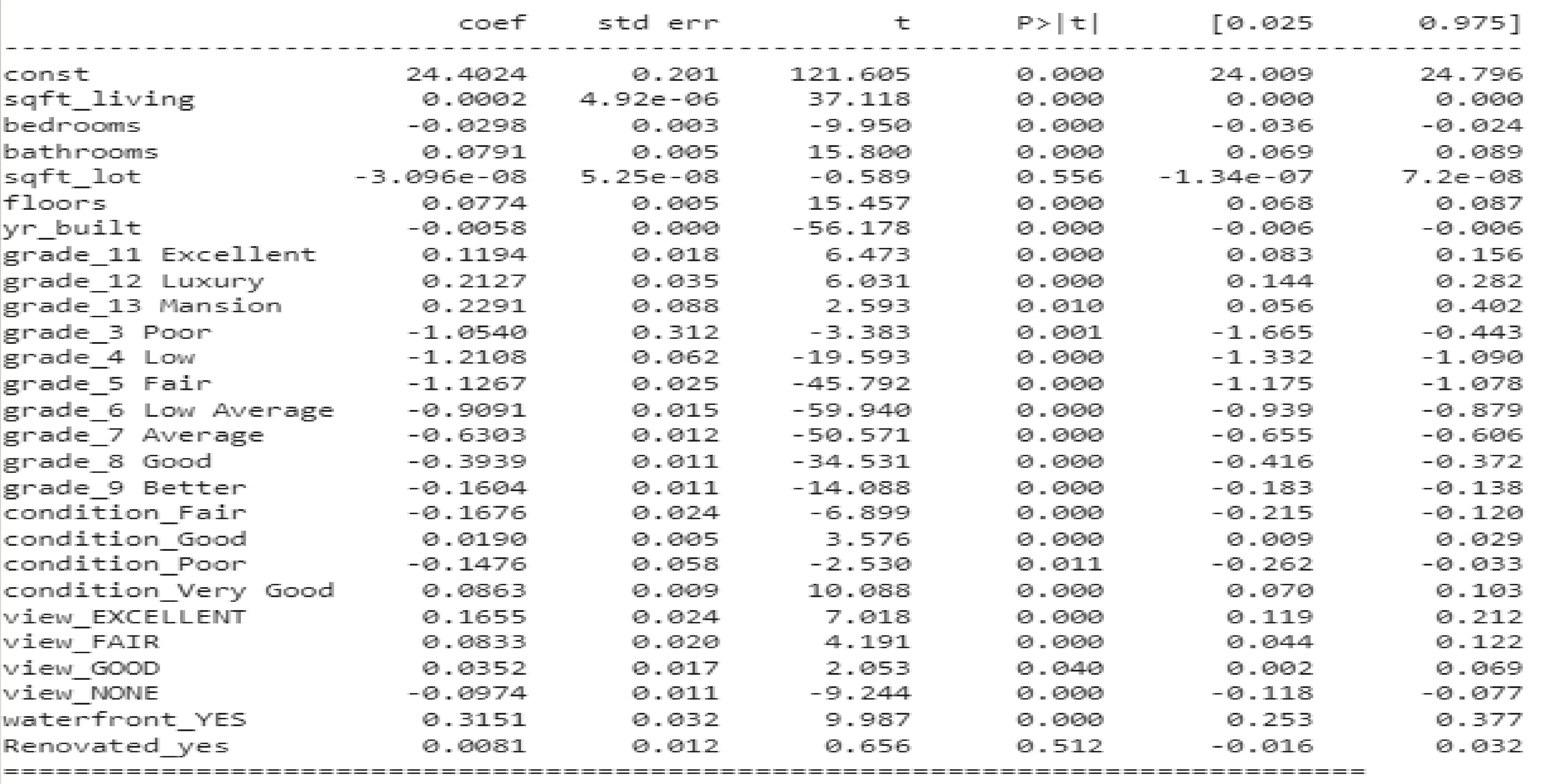
```
                            OLS Regression Results
==============================================================================
Dep. Variable:              price_log   R-squared:                       0.483
Model:                            OLS   Adj. R-squared:                  0.483
Method:                 Least Squares   F-statistic:                 2.020e+04
Date:                Thu, 01 Jun 2023   Prob (F-statistic):               0.00
Time:                        20:33:11   Log-Likelihood:                -9662.2
No. Observations:               21597   AIC:                         1.933e+04
Df Residuals:                   21595   BIC:                         1.934e+04
Df Model:                           1
Covariance Type:            nonrobust
===============================================================================
                  coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------
const          12.2188      0.006   1915.383      0.000      12.206      12.231
sqft_living     0.0004   2.81e-06    142.118      0.000       0.000       0.000
==============================================================================
Omnibus:                        3.541   Durbin-Watson:                   1.978
Prob(Omnibus):                  0.170   Jarque-Bera (JB):                3.562
Skew:                           0.028   Prob(JB):                        0.169
Kurtosis:                       2.973   Cond. No.                     5.63e+03
==============================================================================
```

# FINAL MODEL R-SQUARED



```
                            OLS Regression Results
==============================================================================
Dep. Variable:              price_log   R-squared:                       0.651
Model:                            OLS   Adj. R-squared:                  0.651
Method:                 Least Squares   F-statistic:                     1550.
Date:                Thu, 01 Jun 2023   Prob (F-statistic):               0.00
Time:                        20:35:51   Log-Likelihood:                -5411.9
No. Observations:               21597   AIC:                         1.088e+04
Df Residuals:                   21570   BIC:                         1.109e+04
Df Model:                          26
Covariance Type:            nonrobust
------------------------------------------------------------------------------
```

# FINAL MODEL COEFFICIENTS



```
                           coef    std err          t      P>|t|      [0.025      0.975]
-----------------------------------------------------------------------------------------
const                   24.4024      0.201    121.605      0.000      24.009      24.796
sqft_living              0.0002   4.92e-06     37.118      0.000       0.000       0.000
bedrooms                -0.0298      0.003     -9.950      0.000      -0.036      -0.024
bathrooms                0.0791      0.005     15.800      0.000       0.069       0.089
sqft_lot             -3.096e-08   5.25e-08     -0.589      0.556   -1.34e-07     7.2e-08
floors                   0.0774      0.005     15.457      0.000       0.068       0.087
yr_built                -0.0058      0.000    -56.178      0.000      -0.006      -0.006
grade_11 Excellent       0.1194      0.018      6.473      0.000       0.083       0.156
grade_12 Luxury          0.2127      0.035      6.031      0.000       0.144       0.282
grade_13 Mansion         0.2291      0.088      2.593      0.010       0.056       0.402
grade_3 Poor            -1.0540      0.312     -3.383      0.001      -1.665      -0.443
grade_4 Low             -1.2108      0.062    -19.593      0.000      -1.332      -1.090
grade_5 Fair            -1.1267      0.025    -45.792      0.000      -1.175      -1.078
grade_6 Low Average     -0.9091      0.015    -59.940      0.000      -0.939      -0.879
grade_7 Average         -0.6303      0.012    -50.571      0.000      -0.655      -0.606
grade_8 Good            -0.3939      0.011    -34.531      0.000      -0.416      -0.372
grade_9 Better          -0.1604      0.011    -14.088      0.000      -0.183      -0.138
condition_Fair          -0.1676      0.024     -6.899      0.000      -0.215      -0.120
condition_Good           0.0190      0.005      3.576      0.000       0.009       0.029
condition_Poor          -0.1476      0.058     -2.530      0.011      -0.262      -0.033
condition_Very Good      0.0863      0.009     10.088      0.000       0.070       0.103
view_EXCELLENT           0.1655      0.024      7.018      0.000       0.119       0.212
view_FAIR                0.0833      0.020      4.191      0.000       0.044       0.122
view_GOOD                0.0352      0.017      2.053      0.040       0.002       0.069
view_NONE               -0.0974      0.011     -9.244      0.000      -0.118      -0.077
waterfront_YES           0.3151      0.032      9.987      0.000       0.253       0.377
Renovated_yes            0.0081      0.012      0.656      0.512      -0.016       0.032
==============================================================================
```

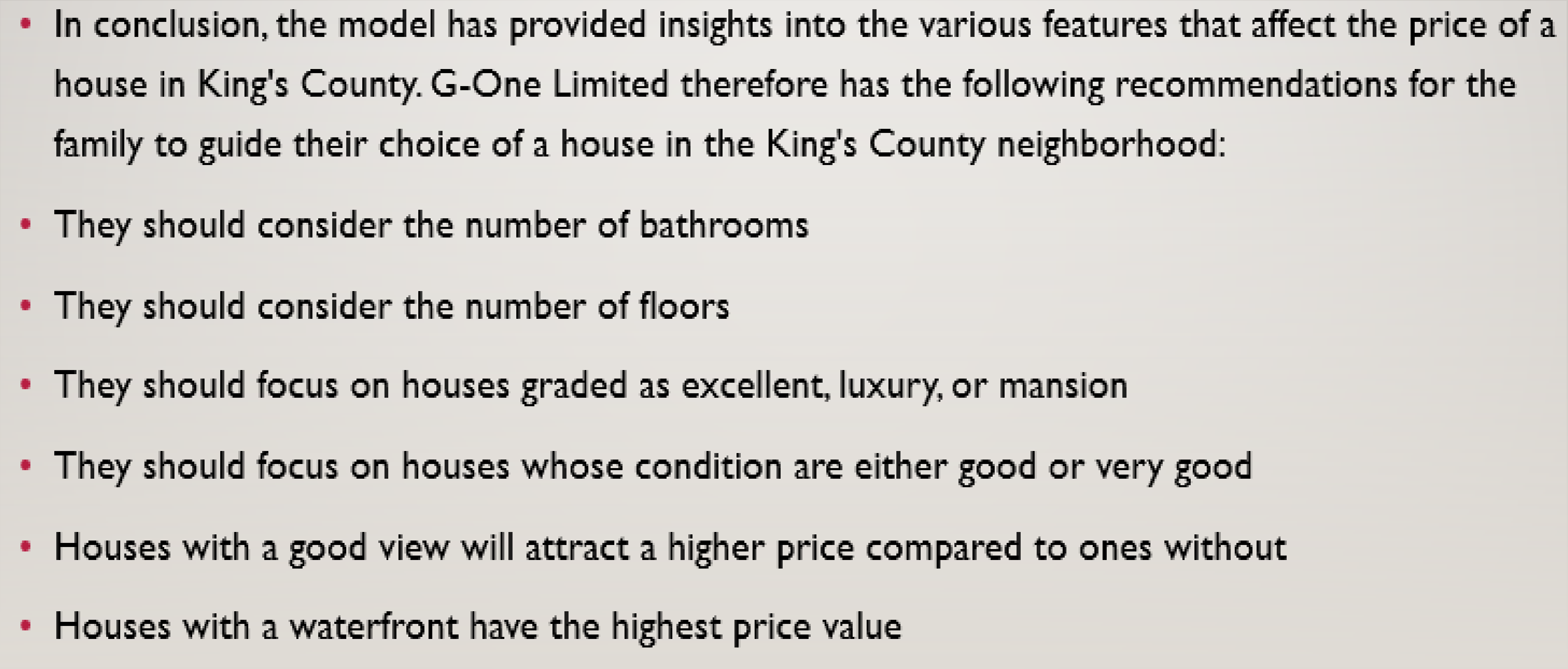
# FINDINGS

- The model is statistically significant overall, with an F-statistic p-value well below 0.05
- The model explains about 65% of the variance in price
- The fact that we went from 1 predictors to 26 predictors and increased R-Squared by 17% from 48% to 65% is an indicator that this a fairly good model
- A number of the model coefficients are statistically significant. These are : "sqft_living, bedrooms, bathrooms, floors, yr_built, grade_11 Excellent, grade_12 Luxury, grade_13 Mansion, grade_3 Poor, grade_4 Low, grade_5 Fair, grade_6 Low Average, grade_7 Average, grade_8 Good, grade_9 Better, condition_Fair, condition_Good, condition_Poor, condition_Very Good, view_EXCELLENT, view_FAIR, view_GOOD, view_NONE, waterfront_YES" have p-values below 0.05 and are therefore statistically significant
- sqft_lot and Renovated_yes have p-values above 0.05 and are therefore not statistically significant at an alpha of 0.05

# INTERPRETATION OF THE COEFFICIENTS

- The following features will improve the pricing of the houses:
- A unit increase in square foot living will increase the price of a house by 0.02%
- A unit increase in the number of bathrooms will increase the price of a house by 7.91%
- A unit increase in the number of floors will increase the price of a house by 7.74%
- The higher the grading of a house, the higher it's price. For instance, a house graded as excellent will attract a price increase of 11.94%, while a house graded as luxury will attract a price increase of 21.27%, and mansion a price increase of 22.91%
- The better the condition of a house, the higher it's price. A house in "good" condition will attract a price increase of 1.9% while a house in "very good" condition will attract a price increase of 8.63%
- Houses without views attract lower prices compared to houses with views. The model demonstrates that a house with a good view attracts a price increase of 3.52%, fair view 8.33%, and excellent view 16.55% increase in price
- Houses with a waterfront attract a price increase of 31.51%

# CONCLUSIONS AND RECOMMENDATIONS



- In conclusion, the model has provided insights into the various features that affect the price of a house in King's County. G-One Limited therefore has the following recommendations for the family to guide their choice of a house in the King's County neighborhood:
- They should consider the number of bathrooms
- They should consider the number of floors
- They should focus on houses graded as excellent, luxury, or mansion
- They should focus on houses whose condition are either good or very good
- Houses with a good view will attract a higher price compared to ones without
- Houses with a waterfront have the highest price value

# THANK YOU