King County Housing Price Analysis

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Summary

Data from King County housing sales was analyzed to determine what housing characteristics correlate to higher housing prices.

Regression Modeling was utilized to come up with a predictive model to determine housing prices.

Insight from the analysis will be used to generate actionable recommendations for the stakeholder.

Outline

- Business Problem
- Data/Methods
- Regression Results
- Conclusions

Business Problem

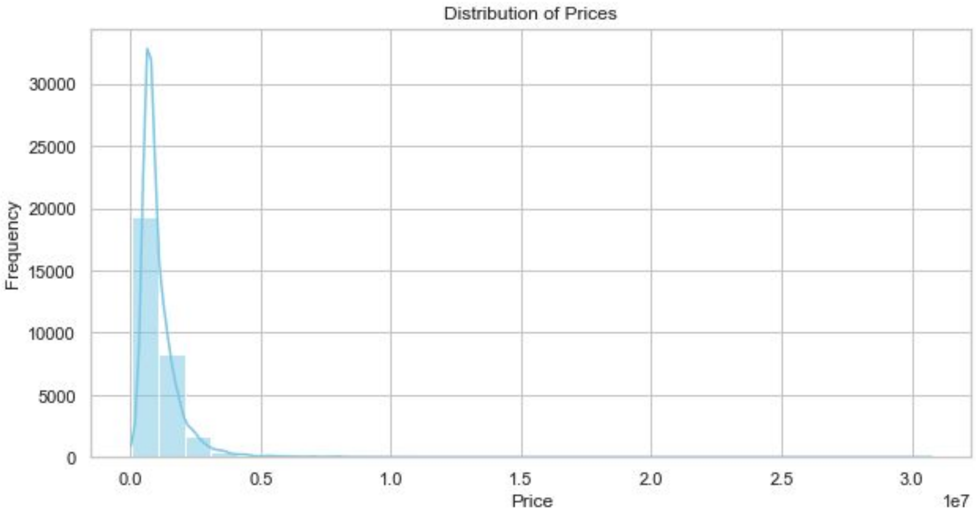
A King County real estate company wants to increase client acquisition and retention through:

- Identifying key housing price characteristics
- Giving sound recommendations
- Improving client's home sale price

Data/Methods

EDA:

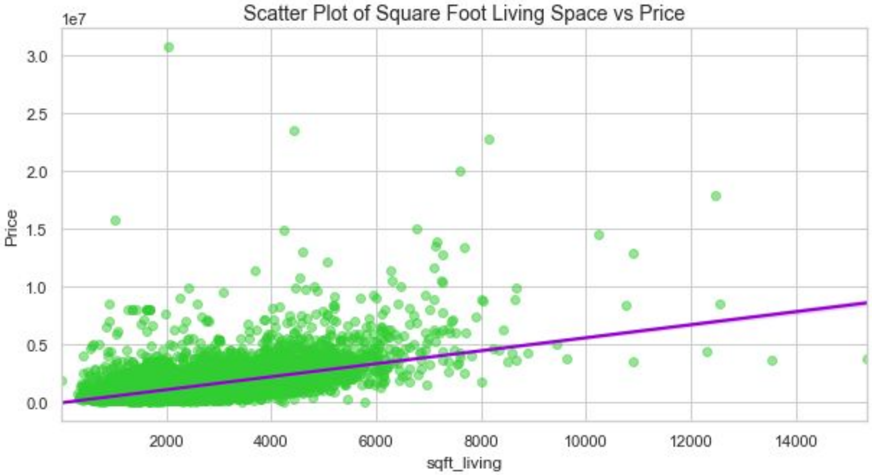
- King County House Sales dataset
- Final dataset:
  - 30,062 entries
  - 21 columns (features)
  - **Sqft_living:** correlation = **0.61**
  - **Grade**: correlation = **0.57**

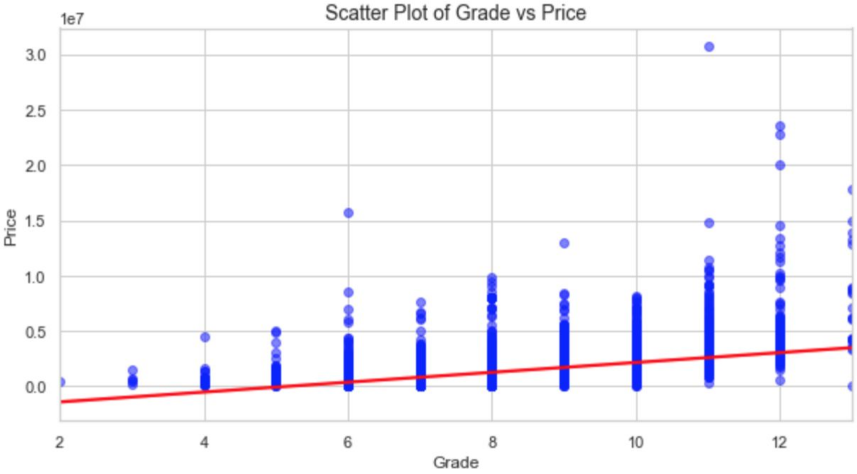


Regression Modeling:

- 6 model iterations were ran
- Target Variable: **Price**

Data/Methods





Regression Results: Baseline Model

R-Squared:

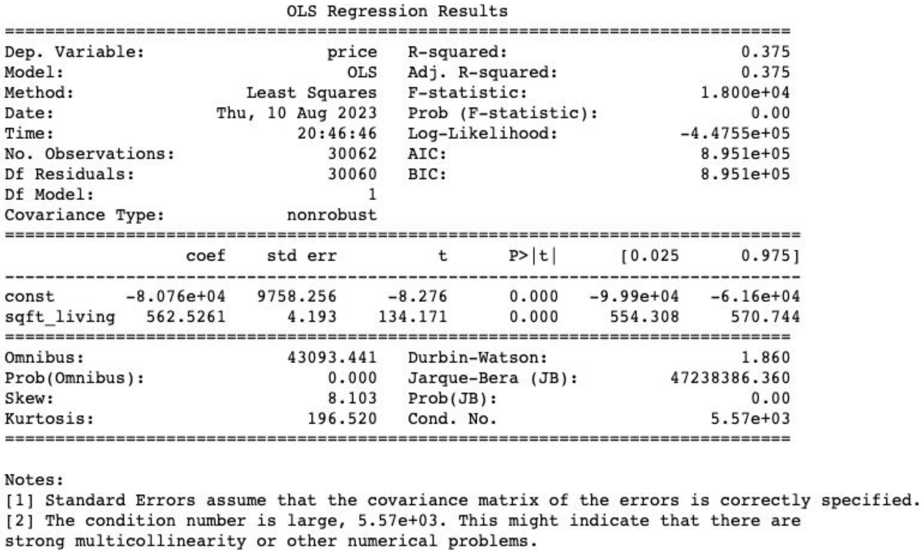
- **0.375** : model explains 37.5% variance in price

Sqft_living:

- 1 sqft increase = **~ 562.53 increase in price (USD)**

High Error Metrics**:**

- MAE of $ 395,915.33
- MSE of $ 706,874.49



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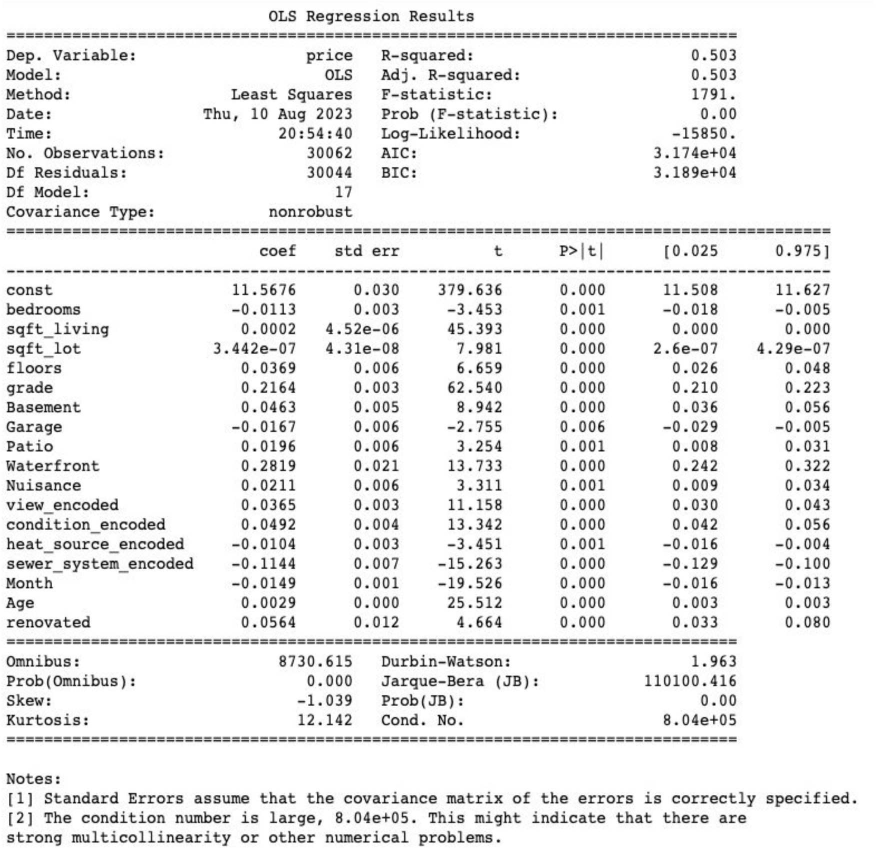
                            OLS Regression Results                            
==============================================================================
Dep. Variable:                  price   R-squared:                       0.375
Model:                            OLS   Adj. R-squared:                  0.375
Method:                 Least Squares   F-statistic:                 1.800e+04
Date:                Thu, 10 Aug 2023   Prob (F-statistic):               0.00
Time:                        20:46:46   Log-Likelihood:            -4.4755e+05
No. Observations:               30062   AIC:                         8.951e+05
Df Residuals:                   30060   BIC:                         8.951e+05
Df Model:                           1                                         
Covariance Type:            nonrobust                                         
===============================================================================
                  coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------
const       -8.076e+04   9758.256     -8.276      0.000   -9.99e+04   -6.16e+04
sqft_living   562.5261      4.193    134.171      0.000     554.308     570.744
==============================================================================
Omnibus:                    43093.441   Durbin-Watson:                   1.860
Prob(Omnibus):                  0.000   Jarque-Bera (JB):         47238386.360
Skew:                           8.103   Prob(JB):                         0.00
Kurtosis:                     196.520   Cond. No.                     5.57e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 5.57e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Regression Results

Final Model:

- R-Squared: **0.503**
- **Grade and Waterfront** = highest in price increase per unit
- **Square foot of living space**:
    - Each 1 square foot increase, there is a **0.02% increase** in average price
- **Condition of home**:
    - Improve by 1 rating = **about 4.92% increase** in average price



```
                            OLS Regression Results
==============================================================================
Dep. Variable:                  price   R-squared:                       0.503
Model:                            OLS   Adj. R-squared:                  0.503
Method:                 Least Squares   F-statistic:                     1791.
Date:                Thu, 10 Aug 2023   Prob (F-statistic):               0.00
Time:                        20:54:40   Log-Likelihood:                -15850.
No. Observations:               30062   AIC:                         3.174e+04
Df Residuals:                   30044   BIC:                         3.189e+04
Df Model:                          17
Covariance Type:            nonrobust
=======================================================================================
                          coef    std err          t      P>|t|      [0.025      0.975]
---------------------------------------------------------------------------------------
const                  11.5676      0.030    379.636      0.000      11.508      11.627
bedrooms               -0.0113      0.003     -3.453      0.001      -0.018      -0.005
sqft_living             0.0002   4.52e-06     45.393      0.000       0.000       0.000
sqft_lot             3.442e-07   4.31e-08      7.981      0.000     2.6e-07    4.29e-07
floors                  0.0369      0.006      6.659      0.000       0.026       0.048
grade                   0.2164      0.003     62.540      0.000       0.210       0.223
Basement                0.0463      0.005      8.942      0.000       0.036       0.056
Garage                 -0.0167      0.006     -2.755      0.006      -0.029      -0.005
Patio                   0.0196      0.006      3.254      0.001       0.008       0.031
Waterfront              0.2819      0.021     13.733      0.000       0.242       0.322
Nuisance                0.0211      0.006      3.311      0.001       0.009       0.034
view_encoded            0.0365      0.003     11.158      0.000       0.030       0.043
condition_encoded       0.0492      0.004     13.342      0.000       0.042       0.056
heat_source_encoded    -0.0104      0.003     -3.451      0.001      -0.016      -0.004
sewer_system_encoded   -0.1144      0.007    -15.263      0.000      -0.129      -0.100
Month                  -0.0149      0.001    -19.526      0.000      -0.016      -0.013
Age                     0.0029      0.000     25.512      0.000       0.003       0.003
renovated               0.0564      0.012      4.664      0.000       0.033       0.080
==============================================================================
Omnibus:                     8730.615   Durbin-Watson:                   1.963
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           110100.416
Skew:                          -1.039   Prob(JB):                         0.00
Kurtosis:                      12.142   Cond. No.                     8.04e+05
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 8.04e+05. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Conclusions/Recommendations

Overall Condition: Optimize the condition of their home.

Square Feet of Living Space: Increase the square footage of living space.

- **1 sqft** = **~0.02 % increase in price**
- Scaled out: **1000 sqft** = **~ 20% increase in price**

Grade: Hire a high quality contractor and invest in high quality materials when building on to the home or making structure improvements/repairs.

- 1 increase in grade level = **~ 21.6% increase in price**

Limitations/ Future Considerations

- The final R-Squared value is 0.503 which suggests that approximately only 50.3% of the variance. Ideally for confidence in the model we want this higher.

- There were columns eliminated from the dataset which could have impact.

- There are other factors of influence that could be explored in further detail such as location and time of year sold.

Thank You!

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