

# Model

$$\hat{y} = 11.9524 + 0.0029 \cdot \hat{x}, \quad \text{where} \quad \hat{y} = \ln(\text{price}) \text{ and } \hat{x} = \text{sqft\_living}^{0.78}$$

## Explanation of the Model

The model has the sample intercept of 11.9524 and the slope of 0.0029. To interpret the slope, we have to transform  $\hat{x}$  and  $\hat{y}$  towards original *sqft\_living* and *price*. Let  $x = \text{sqft\_living}$  and  $y = \text{price}$  for the derivation. We have  $\hat{x} = x^{0.78}$  and  $\hat{y} = \ln(y) \implies y = e^{\hat{y}}$ . Suppose the original sqft.living is  $x_1$  and it moved up to  $x_2$ , then we have the following :

$$\begin{aligned} y_1 &= e^{\hat{y}_1} = e^{11.9524 + 0.0029 \cdot x_1^{0.78}} = e^{11.9524} \cdot e^{0.0029 \cdot x_1^{0.78}} \\ y_2 &= e^{\hat{y}_2} = e^{11.9524 + 0.0029 \cdot x_2^{0.78}} = e^{11.9524} \cdot e^{0.0029 \cdot x_2^{0.78}} \end{aligned}$$

To understand the change in *price* in percents we will use the following formula:

$$\begin{aligned} 100 \times \left[ \frac{y_2 - y_1}{y_1} \right] &= 100 \times \left[ \frac{y_2}{y_1} - 1 \right] = 100 \times \left[ \frac{\cancel{e^{11.9524}} \cdot e^{0.0029 \cdot x_2^{0.78}}}{\cancel{e^{11.9524}} \cdot e^{0.0029 \cdot x_1^{0.78}}} - 1 \right] \\ &= 100 \times \left[ e^{0.0029(x_2^{0.78} - x_1^{0.78})} - 1 \right] \end{aligned}$$

For example, if the *sqft\_living* is 1000 *ft* and we increase it to 1100, we will get the change in price of  $100 \times \left[ e^{0.0029(1100^{0.78} - 1000^{0.78})} - 1 \right]$  5.02%. In this particular example 10% change in sqft\_living starting from  $x_1 = 1000 \text{ft}$  forces 5.02% change in price.