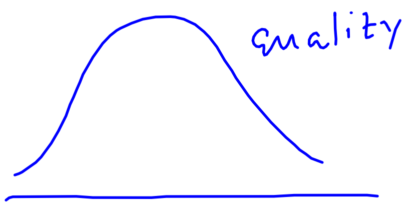
Variance

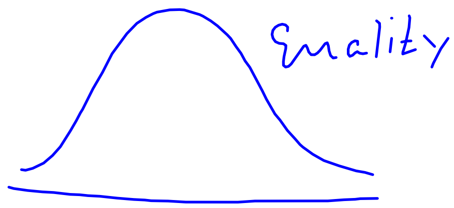
$k = 3$

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + u$$

price sq.ft. bdrms. lotsize quality

x_1, x_2, x_3: 2000, 4, 1 1000, 1, 0.5





Homoskedasticity : $\text{Var}(u \mid x_1, x_2, x_3) = \sigma^2$

$$\text{var}(\hat{\beta}_j) = \frac{\sigma^2}{SST_j (1 - R_j^2)} \qquad j = 1, 2, 3$$

$$SST_j = \sum_{i=1}^{n} (x_{ij} - \bar{x}_j)^2$$

R_j^2 : R^2 from reg. of x_j on other x's price: y

sq. ft. x_1

bdrms x_2

lot size x_3

$$\text{var}(\hat{\beta}_1) = \frac{\sigma^2}{\text{Total variation in sq.ft.} \; (1 - R^2 \text{ from reg. of sq.ft. on bdrms. \& lot size})}$$

$$\sum_{i=1}^{n} (sf_i - \overline{sf})^2$$

R_j^2 close to $\underline{1}$ $\longrightarrow$ multicollinearity

does not violate ass$\underset{..}{\overset{n}{}}$s

for unbiasedness

Under the ass^{n}s up to homoskedasticity

$\hat{\sigma}^2 \rightarrow$ unbiased estimator of σ^2

$$\hat{\sigma}^2 = \frac{\sum_{i=1}^{n} \hat{u}_i^2}{n-k-1} = \frac{\sum_{i=1}^{n} \hat{u}_i^2}{n-3-1}.$$

$k=3$

# of regressors

$$se(\hat{\beta}_j) = \frac{\hat{\sigma}}{\sqrt{SST_j\,(1-R_j^2)}} \qquad j=1,2,3$$