Variance

$k = 3$

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

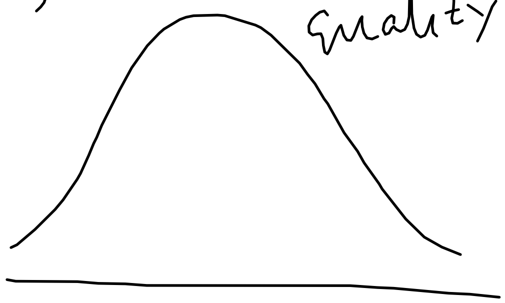
price, sq. ft., # BRs, lotsize, quality

Homoskedasticity

$$Var(u \mid x_1, x_2, x_3) = \sigma^2$$

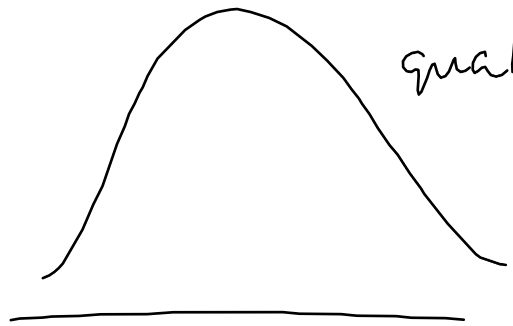
x_1, x_2, x_3 :

2000, 4, 1



quality

1000, 1, 0.5



quality

$Var(\hat{\beta})$?

price : y

sq.ft : x_1

BRs : x_2

lot size : x_3

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

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

SST_j = Total variation in x_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

"Multicollinearity"

R_i^2 close to 1 $\rightarrow$

does not violate assns for unbiasedness

(doesn't mean unimportant!)

HW for 2/18:

what to do if we have multicollinearity?

Under the ass^{n}s up to homosk. :

$\hat{\sigma}^2 \rightarrow$ 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: # of x's

$k = 3$

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