- Variance-Covariance Matrix $var(e)$

$$var(e) = \begin{bmatrix} var(e_1) & cov(e_1, e_2) & \cdots & cov(e_1, e_N) \\ cov(e_2, e_1) & var(e_2) & \cdots & cov(e_2, e_N) \\ \vdots & & \ddots & \\ & & & var(e_N) \end{bmatrix} = \sigma^2 \cdot I_N$$

$$= \begin{bmatrix} \sigma^2 & \emptyset & \emptyset & \cdots & \emptyset \\ \emptyset & \sigma^2 & & & \\ \vdots & & & & \\ \emptyset & & & \ddots & \sigma^2 \end{bmatrix}$$

$var(e_i) = \sigma^2 \Rightarrow$ where does it come from?

$\Downarrow$

$cov(e_i, e_j) = \emptyset \;\; (i \neq j)$

estimated from data

- From the output of summary from lm() in R:

"Residual standard error" is an estimate of σ

- r = vector of residuals:

$$\hat{\sigma} = \sqrt{\frac{1}{N-2} r^T r} = \sqrt{\frac{1}{N-2} \sum_{i=1}^{N} r_i^2}$$

2: number of parameters $\Rightarrow b_0, b_1$