3

- Regression without repeated observations

$$y = X \cdot b + e$$

y → response

X → $\text{Design} = \begin{bmatrix} 1 & BC_1 \\ 1 & BC_2 \\ & \vdots \end{bmatrix}$

$b = \begin{bmatrix} b_0 \\ b_1 \end{bmatrix}$

$e = \begin{bmatrix} e_1 \\ e_2 \\ e_{10} \end{bmatrix}$

- Never considered any property of e

But, we were assuming that

$$var(e_1) = var(e_2) = \ldots = var(e_N) = \sigma_e^2$$

$$cov(e_1, e_2) = cov(e_1, e_3) = \ldots = 0$$

In matrix-vector notation, this is $var(e) = I * \sigma_e^2$

I → Identity matrix

$$\underbrace{var(e)}_{\text{infinite sampling concept}} = \begin{bmatrix} var(e_1) & cov(e_1, e_2) & \ldots \\ cov(e_2, e_1) & var(e_2) & \\ \vdots & & \ddots \\ & & & var(e_N) \end{bmatrix}$$

Check via residuals plot → In R: plot(lm_bw_bc)