

# Monte Carlo experiments

PDF

S42-44

## Experiment 1

$$\text{PRM: } y_i = \beta_1 + \beta_2 x_{2i} + u_i$$

$$\text{SRM: } y_i = b_1 + b_2 x_{2i} + e_i$$

$$\left. \begin{array}{l} \beta_1 = 20 \\ \beta_2 = 2 \\ n = 10 \end{array} \right\} E(y_i | x_{2i}) = 20 + 2x_{2i}; 0 \leq x_{2i} \leq 30$$

Monte Carlo replications

We prepare 50 samples,  $R=50$ :

$$y_i = 20 + 2x_{2i} + u_i; i = 1, \dots, 10$$

drawing from

where  $u \sim N(0, 8^2)$ ,  $\sigma_u = 8$  and thus  $y \sim N(20 + 2x_{2i}, 8^2)$ .

We estimate the PRM on  $R=50$  samples and analyze the distribution of estimates.

## Experiment 2

↑  $R=1000$ , the rest as in E1.

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### Experiment 3

↑  $n=50$ , the rest as in E2.

### Experiment 4

↓  $G_u=4$ , the rest as in E3.

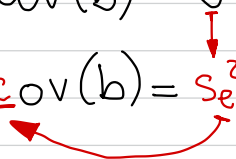
### Experiment 5

$\text{Var}(x_2)$  ↑, such that  $0 \leq x_{2i} \leq 100$ ,  
the rest as in E4.

Estimator of the var-cov matrix of  $b$ :

$$\text{Var} - \text{Cov}(b) = \sigma^2 \cdot (X^T X)^{-1}$$

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$$\underline{\text{var}} - \underline{\text{cov}}(b) = \underline{s_e^2} \cdot (X^T X)^{-1}$$


Testing a regression coefficient:

$$H_0: \beta_j = \beta_{j0}$$

$$H_1: \beta_j \neq \beta_{j0}$$

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$n - k$ : degrees of freedom

Decomposition of sum of squares: Slide 58

$$\begin{array}{ccccc} \text{Total SS} & = & \text{Explained SS} & + & \text{Residual SS} \\ \text{TSS} & = & \text{ESS} & + & \text{RSS} \end{array}$$

Multiple determination coefficient:

$$0 \leq R^2 \leq 1$$

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Example:

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$$R^2 = 0.25$$

$$n = 12$$

$$k = 5$$

$$\begin{aligned} \bar{R}^2 &= R^2_{\text{adj}} = 1 - (1 - R^2) \cdot \frac{n-1}{n-k} = \\ &= 1 - 0.75 \cdot 1.571 = \underline{\underline{-0.179}} \end{aligned}$$

Testing stat. sign. of the model as a whole:

$$\begin{aligned} H_0: & \beta_j = 0, \text{ for every } j = 2, \dots, k \\ H_1: & \beta_j \neq 0, \text{ for at least one } j = 2, \dots, k \end{aligned}$$

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