Monte Carlo experiments

PDF

S42-44

Experiment 1

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

↓ $6_u = 4$, the rest as in E3.

Experiment 5

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

Estimator of the var-cov matrix of b:

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

$$\underline{v}ar - \underline{c}ov(b) = s_e^2 \cdot (X^T X)^{-1}$$

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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

Total SS = Explained SS + Residual SS
TSS = ESS + RSS

Multiple determination coefficient:

$0 \leq R^2 \leq 1$

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Example: Slide 60

$R^2 = 0.25$
$n = 12$
$k = 5$

$$\bar{R}^2 = R^2_{adj} = 1 - (1 - R^2) \cdot \frac{n-1}{n-k} =$$
$$= 1 - 0.75 \cdot 1.571 = -0.179$$

Testing stat. sign. of the model as a whole: Slide 62

$H_0: \beta_j = 0, \ \forall j = 2, \dots, k$ (for every)
$H_1: \beta_j \neq 0, \ \exists j = 2, \dots, k$ (for at least one)