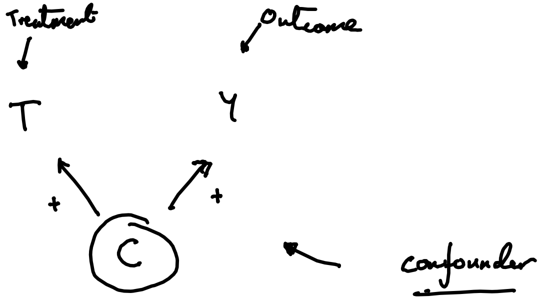
EC2020 Session 2

tomglinnan.github.io/EC2020



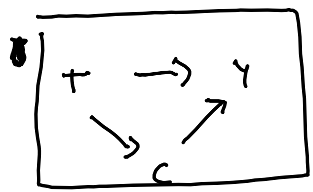
$$y_i = \alpha + \beta T_i + \underbrace{\varepsilon_i}_{C_i} \qquad (\hat{\alpha}, \hat{\beta})$$

$$\mathbb{E}\,\varepsilon_i T_i \neq 0$$

T = Health insurance

Y = Health

C = ~~Socio-Economic status~~ Wealth



$$y_i = \alpha + \beta^s T_i + \varepsilon_i \qquad \frac{d y_i}{d T_i} = \beta^s$$

$$y_i = \alpha + \beta^l T_i + \gamma C_i + \varepsilon_i \qquad \beta^l = \frac{\partial y_i}{\partial T_i}$$

Partial derivative

$\Rightarrow$ "holding other variables constant"

(C_i)

$\underline{Q\,4}$

$$y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i$$

$(\hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3)$ $\qquad$ $Var(\hat{\beta}_2 | X)$ under $\underline{GM}$.

SLR1: ....

SLR2: $\hat{Var}(X_{2i}) \neq 0$ $\quad \hat{Var}(X_{3i}) \neq 0$ $\quad$ multicollinearity

no perfect correlation between variables

SLR3: $\mathbb{E}(\varepsilon_i | X_{2i}, X_{3i}) = 0$ $\quad \cancel{\mathbb{E}\,\varepsilon_i = 0}$

] OLS's "main" good properties (unbiased / consistent)

SLR4: $Var(\varepsilon_i) = \sigma^2$ $\quad$ homoscedasticity

SLR5: $cor(\varepsilon_i, \varepsilon_j) = 0$ for $i \neq j$ $\quad$ no autocorrelation

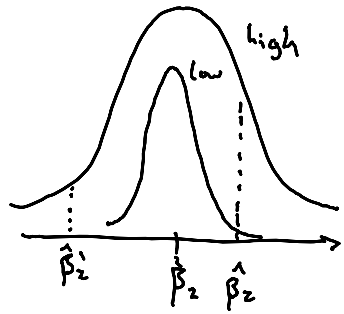
] Bonus (efficient)

4) $$\text{Var}(\hat{\beta}_2) = \frac{\sigma^2}{\left[\frac{1}{n}\sum (X_{2i}-\bar{X}_{2i})^2\right]\cdot n} \cdot \frac{1}{1-R^2_{x_2x_3}} = \frac{\sigma^2}{\hat{\text{Var}}(X_{2i}) \cdot n \cdot (1-R^2_{x_2x_3})}$$

$$y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \underline{\varepsilon_i} \leftarrow R^2$$

$$+ \beta_4 X_{4i} + \varepsilon_i$$

$$\hat{\beta}_2 = \frac{\hat{\text{cov}}(y_i, \hat{X}_{2i})}{\hat{\text{Var}}(\hat{X}_{2i})}$$



centered on $\beta_2 \Leftrightarrow$ unbiased

$\text{Var}(\hat{\beta}_2)$

$R^2_{x_2,x_3}$

$$X_{2i} = \gamma_1 + \gamma_2 X_{3i} + u_i$$

1. n is big
2. $\hat{\text{Var}}(X_{2i})$ is large
3. σ^2 is low
4. X_2, X_3 not very correlated

MC: $R^2_{x_2,x_3} = 1$

Near MC: $R^2_{x_2,x_3} \sim 1$

$$\text{Life expectancy}_i = \alpha + \underset{\overset{\shortparallel}{5}}{\beta}\,\text{Health}_i + \varepsilon_i$$

"Interpret β" $\Rightarrow$ "give a sentence saying what β means"

LE: Years

H : \$USD

\$1 increase in Health
is assosciated with β
extra years of life expectancy
keeping all else equal

↳ CORRELATION STATEMENT

Imagine HealthK : \$1000 USD

$$LE_i = \alpha^k + \underset{\overset{\shortparallel}{\frac{5}{1000} \text{ or } \cancel{5000}}}{\beta^k}\,\text{Health}K_i + u_i$$

$\cancel{\beta\,\text{Health}_i} = \beta^k\,\text{Health}K_i$

$\cancel{\beta \cdot 1000\,\text{Health}K_i = \beta^k\,5000}$