Vectores

- $\langle \boldsymbol{x},\, \boldsymbol{y}\rangle_e = \sum_{i=1}^{n} x_i y_i$
  $\langle \boldsymbol{x},\, \boldsymbol{y}\rangle_s = \frac{1}{n}\langle \boldsymbol{x},\, \boldsymbol{y}\rangle_e$
- $\|\boldsymbol{x}\| = \sqrt{\langle \boldsymbol{x},\, \boldsymbol{x}\rangle}$ (con $\langle,\rangle_e$ o con $\langle,\rangle_s$)
- $\boldsymbol{x} \perp \boldsymbol{y}$ si $\langle \boldsymbol{x},\, \boldsymbol{y}\rangle = 0$ $\qquad \cos\theta = \dfrac{\langle \boldsymbol{x},\, \boldsymbol{y}\rangle}{\|\boldsymbol{x}\|\,\|\boldsymbol{y}\|}$

Media, dispersión y correlación

- $\mu_{\boldsymbol{y}} = \langle \boldsymbol{y},\, \mathbf{1}\rangle_s = \frac{1}{n}\sum_i y_i$ $\qquad \overline{\boldsymbol{y}} = \mu_{\boldsymbol{y}}\mathbf{1}$
- $\sigma_{\boldsymbol{y}} = \|\boldsymbol{y} - \overline{\boldsymbol{y}}\|_s$ $\qquad \sigma^2_{\boldsymbol{y}} = \frac{1}{n}\sum_i (y_i - \mu_{\boldsymbol{y}})^2$
- $\sigma_{\boldsymbol{xy}} = \langle \boldsymbol{x} - \overline{\boldsymbol{x}},\, \boldsymbol{y} - \overline{\boldsymbol{y}}\rangle_s$
- $\rho_{\boldsymbol{xy}} = \dfrac{\sigma_{\boldsymbol{xy}}}{\sigma_{\boldsymbol{x}}\,\sigma_{\boldsymbol{y}}}$

Ajuste MCO

- n observaciones y k regresores ($\mathbf{1}$ incluido)
- $\boldsymbol{y} = \widehat{\boldsymbol{y}} + \widehat{\boldsymbol{e}}$, con $\widehat{\boldsymbol{y}} = \hat\beta_1\mathbf{1} + \hat\beta_2\boldsymbol{x}_2 + \cdots + \hat\beta_k\boldsymbol{x}_k$
- Con $k = 2$:
  $\hat\beta_2 = \dfrac{\sigma_{\boldsymbol{xy}}}{\sigma^2_{\boldsymbol{x}}}$ $\qquad \hat\beta_1 = \mu_{\boldsymbol{y}} - \hat\beta_2\,\mu_{\boldsymbol{x}}$

Sumas de cuadrados y R^2

- $\mathrm{STC} = \|\boldsymbol{y} - \overline{\boldsymbol{y}}\|^2_e$ $\qquad \mathrm{SEC} = \|\widehat{\boldsymbol{y}} - \overline{\boldsymbol{y}}\|^2_e$
- $\mathrm{SRC} = \|\widehat{\boldsymbol{e}}\|^2_e$ $\qquad \mathrm{STC} = \mathrm{SEC} + \mathrm{SRC}$
- $R^2 = \dfrac{\mathrm{SEC}}{\mathrm{STC}} = 1 - \dfrac{\mathrm{SRC}}{\mathrm{STC}}$
- Corregido: $\quad \bar R^2 = 1 - \dfrac{\mathrm{SRC}/(n-k)}{\mathrm{STC}/(n-1)}$

Modelo

- $Y = \beta_1 1 + \beta_2 X_2 + \cdots + \beta_k X_k + U$
- Perturbación: $\quad U = Y - E[Y \mid X_2, \ldots, X_k]$
- Con $k = 2$ y $Var[U_i \mid \boldsymbol{X}] = \sigma^2\, 1$:
  $Var[\hat\beta_2 \mid \boldsymbol{X}] = \dfrac{\sigma^2}{\sum_i (X_i - \overline{X})^2}$

Error estándar, contraste t e intervalo

- $\mathfrak{s}^2 = \dfrac{\mathrm{SRC}}{n-k}$
- $\mathrm{ee}(\hat\beta_j) = \dfrac{\mathfrak{s}}{\|\tilde{\boldsymbol{x}}_j\|_e}$
  ($\tilde{\boldsymbol{x}}_j$: parte propia, ortogonal a los demás)
- Si $\beta_j = c$: $\quad t = \dfrac{\hat\beta_j - c}{\mathrm{ee}(\hat\beta_j)} \sim t_{n-k}$
- Intervalo: $\quad \hat\beta_j \pm t_c \cdot \mathrm{ee}(\hat\beta_j)$

Contraste F

- Con q restricciones y SRC_r (del modelo restringido), bajo H_0:
  $F = \dfrac{(\mathrm{SRC}_r - \mathrm{SRC})/q}{\mathrm{SRC}/(n-k)} \sim F_{q,\,n-k}$
- Significación conjunta ($q = k - 1$):
  $F = \dfrac{\mathrm{SEC}/(k-1)}{\mathrm{SRC}/(n-k)} = \dfrac{n-k}{k-1}\cdot\dfrac{R^2}{1-R^2}$

Colinealidad

- $\mathrm{VIF}_j = \dfrac{1}{1 - R^2_j}$
  (R^2_j: el R^2 de $\boldsymbol{x}_j$ sobre los demás)

Logaritmos

- Logaritmo natural: $\quad \log(ab) = \log a + \log b$
- $\log(1+p) \approx p$ si p es pequeño
- Si $\log y$ sube β, y se multiplica por e^β
  (cambio relativo: $e^\beta - 1$)

nivel-nivel	$Y = \beta_1 1 + \beta_2 X + U$
log-nivel	$\log Y = \beta_1 1 + \beta_2 X + U$
nivel-log	$Y = \beta_1 1 + \beta_2 \log X + U$
log-log	$\log Y = \beta_1 1 + \beta_2 \log X + U$

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