



ceteris paribus : all else equal

crime ← unemp.

location

laws

police

educ.

Definition

objective: estimate the effect of X on Y

Y
dependent var.
explained
regressand

X
independent var.
explanatory
regressor

e.g. pollution
wage

trade
educ.

Simple linear regression (SLR) model

$$y = \beta_0 + \beta_1 x + u$$

intercept slope unobserved
or error term

$$\Delta y = \beta_1 \Delta x + \Delta u$$

β_1 : Δy for $\Delta x = 1$ (all else constant)

Objective : estimate β_0 and β_1

2 assumptions :

$$E(u) = 0$$

$$E(u|x) = E(u)$$

$$\Rightarrow E(u|x) = 0$$

$$\text{corr.}(x, u) = 0$$

$$E(x \cdot u) = 0$$

Deriving OLS estimates

Sample analogs : estimates $\hat{\beta}_0$ and $\hat{\beta}_1$ such that

$$\frac{1}{n} \sum_{i=1}^n (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) = 0$$

n : sample size

i : obs i
 $1, 2, \dots, n$

$$\frac{1}{n} \sum_{i=1}^n x_i (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) = 0$$