

ECOG 219: Introduction to Econ Mathematics

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- $y_i = \beta x_i + \epsilon_i$
- $E(X \cdot \epsilon) = 0$
- $\epsilon \sim N(0, \sigma^2)$
- Let z be a random variable.
- $E(z)$ is the first moment
- $E(z^2)$ is the second moment

$$\begin{aligned} E(x_i(y_i - \beta x_i)) &= 0 \\ \frac{1}{n} \sum_i^n x_i(y_i - \beta x_i) &= 0 \\ \sum_i^n x_i y_i - \beta \sum_i^n x_i^2 &= 0 \\ \hat{\beta} &= \frac{\sum_i^n x_i y_i}{\sum_i^n x_i^2} \end{aligned}$$

minimicing the errors:

$$\begin{aligned} u_i &= y_i - \beta x_i \\ \beta &= (X^T X)^{-1} X^T Y \end{aligned}$$