

Università di Pavia  
**Econometria**

**Esempio**

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## Modello di regressione lineare semplice

$K = 2$ .

$$\mu_t = \beta_1 + \beta_2 x_{1t}$$

$$\hat{\beta} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{y}$$

$$(\mathbf{X}'\mathbf{X}) = \begin{bmatrix} N & \sum_t x_{1t} \\ \sum_t x_{1t} & \sum x_{1t}^2 \end{bmatrix}$$

$$(\mathbf{X}'\mathbf{X})^{-1} = \begin{bmatrix} N & \sum_t x_{1t} \\ \sum_t x_{1t} & \sum x_{1t}^2 \end{bmatrix}^{-1}$$

$$\hat{\beta}_1 = \hat{y} - \hat{\beta}_1 \bar{x}_1$$

## Modello di regressione lineare semplice

$$\hat{\beta}_2 = \frac{\frac{1}{N} \sum_t (y_t - \bar{y})(x_{1t} - \bar{x}_1)}{\frac{1}{N} \sum_{t=1}^N (x_t - \bar{x}_1)}$$

## Esempio

$t$		$x'_t$	$y_t$
1	1	1.51	2.88
2	1	2.33	3.62
3	1	3.57	5.64
4	1	2.12	3.43
5	1	1.54	3.21
6	1	1.71	4.49
7	1	2.68	4.50
8	1	2.25	4.28
9	1	1.32	2.98
10	1	2.80	5.57

## Esempio

$$y = \begin{bmatrix} 2.88 \\ 3.62 \\ 5.64 \\ 3.43 \\ 3.21 \\ 4.49 \\ 4.50 \\ 4.28 \\ 2.98 \\ 5.57 \end{bmatrix} \quad X = \begin{bmatrix} 1 & 1.51 \\ 1 & 2.33 \\ 1 & 3.57 \\ 1 & 2.12 \\ 1 & 1.54 \\ 1 & 1.71 \\ 1 & 2.68 \\ 1 & 2.25 \\ 1 & 1.32 \\ 1 & 2.80 \end{bmatrix}$$

## Esempio

$$\mathbf{X}'\mathbf{X} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1.51 & 2.33 & 3.57 & 2.12 & 1.54 & 1.71 & 2.68 & 2.25 & 1.32 & 2.80 \end{bmatrix} \begin{bmatrix} 1 \\ 1.51 \\ 2.33 \\ 3.57 \\ 2.12 \\ 1.54 \\ 1.71 \\ 2.68 \\ 2.25 \\ 1.32 \\ 2.80 \end{bmatrix}$$

$$\mathbf{X}'\mathbf{X} = \begin{bmatrix} 10 & 21.83 \\ 21.83 & 52.0713 \end{bmatrix}$$

$$(\mathbf{X}'\mathbf{X})^{-1} = \begin{bmatrix} 1.1790413 & -0.49429288 \\ -0.49429288 & 0.22642825 \end{bmatrix}$$

## Esempio

$$\hat{\beta} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{y} = \begin{bmatrix} 1.390 \\ 1.223 \end{bmatrix}$$

$$\mathbf{y} - \mathbf{X}\hat{\beta} = \begin{bmatrix} -0.356977 \\ -0.619769 \\ -0.116185 \\ -0.552956 \\ -0.063664 \\ 1.008439 \\ -0.167789 \\ 0.138065 \\ -0.024623 \\ 0.755461 \end{bmatrix}$$

## Esempio

$$\mathbf{X}'(\mathbf{y} - \mathbf{X}\hat{\boldsymbol{\beta}}) = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$