# Model multiple regresije

Slide 2

Odvisna spremenljivka: $y$

Pojasnjevalne spremenljivke: $x_j$ ; $j = 1, \dots, k$

Ločimo med:

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1) časovnimi vrstami $(t)$;
2) presečnimi podatki $(i)$;
3) panelnimi podatki $(it)$.

Pogojevanje: predpostavimo $E(Q|L) = f(L)$.

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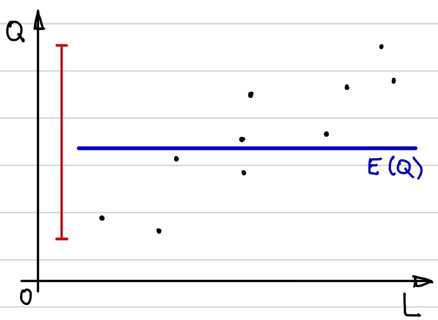
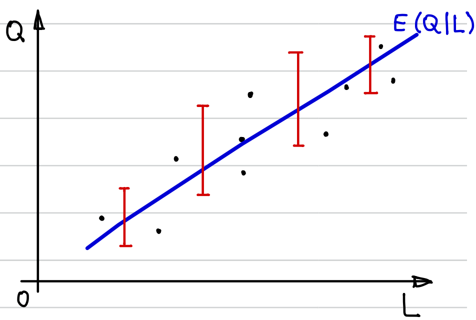
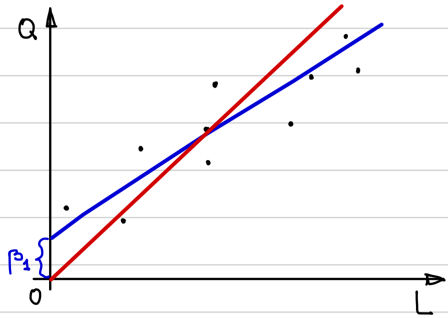



Pogojevanje zmanjšuje variabilnost mer.

Vključitev konstantnega člena:

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Slide 10

| | | | |
|---|---|---|---|
| PRM vs. | $E(y \mid X)$ | $\beta$ | $u$ |
| VRM | $\hat{y}$ | $b$ ali $\hat{\beta}$ | $e$ ali $\hat{u}$ |

V mislih imejmo primer VRM:

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$$Q_i = \underbrace{b_1 + b_2 L_i + b_3 K_i}_{\hat{Q}_i} + e_i$$

(ocenjene vrednosti)

## Slide 14:

Cenilka regresijskih koeficientov $\beta$, tj. obrazec za izračun ocen regresijskih koeficientov $b$, mora nekako minimizirati ostanke $e_i$:

$$e_i = y_i - \hat{y}_i$$

Neskončno število možnosti:

1) $\min\limits_{b} \sum\limits_{i=1}^{n} e_i$ ✗

2) $\min\limits_{b} \sum\limits_{i=1}^{n} |e_i|$ ✗ (samo v nekaterih okoliščinah)

3) $\min\limits_{b} \sum\limits_{i=1}^{n} e_i^2$ ✓ "optimalno" $\longmapsto$ Metoda najmanjših kvadratov

itd.

Zelo priklادna je uporaba matričnega zapisa:

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□ – presečni podatki
□ – časovne vrste

$$\underset{\substack{n\times 1\\ T\times 1}}{y} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_{n/T} \end{bmatrix}$$

$$\underset{\substack{n\times 1\\ T\times 1}}{x_1} = \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} \quad \underset{\substack{n\times 1\\ T\times 1}}{x_2} = \begin{bmatrix} x_{21} \\ x_{22} \\ \vdots \\ x_{2n/T} \end{bmatrix} \quad \dots \quad \underset{\substack{n\times 1\\ T\times 1}}{x_k} = \begin{bmatrix} x_{k1} \\ x_{k2} \\ \vdots \\ x_{kn/T} \end{bmatrix}$$

$$\underset{\substack{n\times k\\ T\times k}}{X} = \begin{bmatrix} 1 & x_{21} & \dots & x_{k1} \\ 1 & x_{22} & \dots & x_{k2} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{2n/T} & \dots & x_{kn/T} \end{bmatrix}$$

$$\text{"}x_1\text{"} \quad x_2 \quad \dots \quad x_k$$

$$\underset{\substack{n\times 1\\ T\times 1}}{e} = \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_{n/T} \end{bmatrix}$$

$$\underset{k\times 1}{b} = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_k \end{bmatrix}$$

$$\underset{\substack{n\times 1\\ T}}{y} = \underbrace{\underset{(n\times k)(k\times 1)}{X \cdot b}}_{\substack{n\times 1\\ T}} + \underset{\substack{n\times 1\\ T}}{e} \quad \text{in} \quad e = y - X\cdot b$$

Spomnimo se:

$$e^T e = [e_1 \; e_2 \; \dots \; e_n] \cdot \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{bmatrix} =$$

$$= e_1^2 + e_2^2 + \dots + e_n^2 = \sum_{i=1}^{n} e_i^2 \longmapsto \text{Slide 18}$$

Sistem normalnih enačb:

$$(X^T X)^{-1} \cdot / \quad X^T y = (X^T X) b \qquad \text{Slide 19}$$

$$(X^T X)^{-1} X^T y = \underbrace{(X^T X)^{-1} X^T X}_{I} b$$

$$b = (X^T X)^{-1} X^T y$$

CENILKA REGRESIJSKIH KOEFICIENTOV
PO METODI NAJMANJŠIH KVADRATOV

Spomnimo se: Slide 20

$$X^T e = 0 \iff \sum_{i=1}^{n} x_{ji} \cdot e_i = 0, \; \forall j = 1, \dots, k$$

$$\hat{y}^T e = 0 \iff \sum_{i=1}^{n} \hat{y}_i \cdot e_i = 0$$