## Lineární regrese a korelace

$$b_{yx} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{n\sum x_i^2 - (\sum x_i)^2} \qquad a_{yx} = \bar{y} - b_{yx}\bar{x}$$

$$r_{yx} = r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{\left[n\sum x_i^2 - \left(\sum x_i\right)^2\right]\cdot\left[n\sum y_i^2 - \left(\sum y_i\right)^2\right]}}$$

$$r_{yx} = r_{xy} = \pm\sqrt{b_{yx}\cdot b_{xy}}$$

$$r_{yx} = \frac{s_{xy}}{s_x.s_y} \qquad r_{yx} = b_{yx}\frac{s_x}{s_y} \qquad r_{yx} = b_{xy}\frac{s_y}{s_x} \qquad \left|r_{yx}\right| = \sqrt{b_{yx}.b_{xy}}$$

$$b_{yx} = r_{yx}\frac{s_y}{s_x} \qquad b_{xy} = r_{yx}\frac{s_x}{s_y}$$

## Nelineární regrese a korelace

Příklad – funkce lomená : $y_i' = a + \frac{b}{x_i}$

Soustava rovnic : $na + b\sum\frac{1}{x_i} = \sum y_i$

$$a\sum\frac{1}{x_i} + b\sum\frac{1}{x_i^2} = \sum\frac{y_i}{x_i}$$

$$I_{yx} = \sqrt{1 - \frac{\sum(y_i - y_i')^2}{\sum(y_i - \overline{y})^2}}$$

## Spearmanův koeficient korelace

$$r_s = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

## Analýza časových řad

$$k_i = \frac{y_i}{y_{i-1}} \qquad \bar{k} = \sqrt[n-1]{\frac{y_n}{y_1}}$$

$$z_i = \frac{y_i}{y_0}$$

Trendové funkce a soustava normálních rovnic

$$y_i^{/} = a + bt_i \qquad \begin{aligned} na + b\sum t_i &= \sum y_i \\ a\sum t_i + b\sum t_i^2 &= \sum y_i t_i \end{aligned}$$

$$y_i^{/} = a + bt_i + ct_i^2 \qquad \begin{aligned} na + b\sum t_i + c\sum t_i^2 &= \sum y_i \\ a\sum t_i + b\sum t_i^2 + c\sum t_i^3 &= \sum y_i t_i \\ a\sum t_i{}^2 + b\sum t_i^3 + c\sum t_i^4 &= \sum y_i t_i{}^2 \end{aligned}$$

$$y_i^{/} = a + \frac{b}{t_i} \qquad \begin{aligned} na + b\sum \frac{1}{t_i} &= \sum y_i \\ a\sum \frac{1}{t_i} + b\sum \frac{1}{t_i{}^2} &= \sum \frac{y_i}{t_i} \end{aligned}$$

$$I_{yx} = \sqrt{1 - \frac{\sum (y_i - y_i^{/})^2}{\sum (y_i - \overline{y})^2}}$$

$$s_i = \frac{y_i}{y_i^{/}}$$

$$\text{M.A.P.E} = \frac{100}{n}\sum \left| \frac{y_i - y_i^{/}}{y_i} \right|$$

$$\text{r} = \frac{P - S}{S}.100 \quad (\%)$$

$$T_H^2 = \frac{\sum (S - P)^2}{\sum S^2} \qquad T_H = \sqrt{T_H^2}\ .100 \quad (\%)$$

**Indexní analýza**

Individuální indexy

$$\frac{\frac{\sum p_1 q_1}{\sum q_1}}{\frac{\sum p_0 q_0}{\sum q_0}} = \frac{\frac{\sum p_1 q_1}{\sum q_1}}{\frac{\sum p_0 q_1}{\sum q_1}} \cdot \frac{\frac{\sum p_0 q_1}{\sum q_1}}{\frac{\sum p_0 q_0}{\sum q_0}}$$

$$\frac{\frac{\sum p_1 q_1}{\sum q_1}}{\frac{\sum p_0 q_0}{\sum q_0}} = \frac{\frac{\sum p_1 q_0}{\sum q_0}}{\frac{\sum p_0 q_0}{\sum q_0}} \cdot \frac{\frac{\sum p_1 q_1}{\sum q_1}}{\frac{\sum p_1 q_0}{\sum q_0}}$$

Souhrnné indexy

$$\frac{\sum c_1 q_1}{\sum c_0 q_0} = \frac{\sum c_1 q_1}{\sum c_0 q_1} \cdot \frac{\sum c_0 q_1}{\sum c_0 q_0}$$

$$\frac{\sum c_1 q_1}{\sum c_0 q_0} = \frac{\sum c_1 q_0}{\sum c_0 q_0} \cdot \frac{\sum c_1 q_1}{\sum c_1 q_0}$$

**Asociační tabulka**

$$\chi^2 = \frac{n(ad-bc)^2}{(a+b)(a+c)(b+d)(c+d)}$$

$$\mathbf{p_i} = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{n!a!b!c!d!}$$

**Určení síly závislosti v asociační tabulce**

Koeficient asociace $V = \frac{ad-bc}{\sqrt{(a+b)(c+d)(a+c)(b+d)}}$

$$|V| = \sqrt{\frac{\chi^2}{n}}$$

Koeficient korelace $r_{ab} = \frac{na-(a+b)(a+c)}{\sqrt{(a+b)(c+d)(a+c)(b+d)}}$

Kontingenční tabulka

Očekávané četnosti $n_{oj} = \frac{n_{i\bullet}n_{\bullet j}}{n}$

**$\chi^2$ test pro nezávislost**

$$\chi^2 = \sum\sum \frac{(n_{ij}-n_{oj})^2}{n_{oj}}$$

Je- li $\chi^2 > \chi^2_{\alpha(k-1)(m-1)}$ nulovou hypotézu o nezávislosti zamítáme

**Určení síly závislosti**

Pearsonův koeficient $C = \sqrt{\frac{\chi^2}{\chi^2+n}}$

maximální hodnota $C_{max}$

normalizovaný koeficient $C_n = \frac{C}{C_{max}}$

Cramerův koeficient kontingence $V = \sqrt{\frac{\chi^2}{n(q-1)}}$ , q = min k, m

**Další užití kontingenčních tabulek**

Mc Nemarův test $\chi^2 = \frac{(b-c)^2}{b+c}$

RR $= \frac{a(c+d)}{c(a+b)}$ OR $= \frac{ad}{bc}$

AR $= \frac{a}{a+b} - \frac{c}{c+d}$ AF $= \frac{\frac{a}{a+b} - \frac{c}{c+d}}{\frac{a}{a+b}}$