Hoofdstuk 16

Bijlage 16.1

First-Order Linear Model

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

where

y = dependent variable

x = independent variable

β_0 = y-intercept

β_1 = slope of the line (defined as rise/run)

ε = error variable

Bijlage 16.2

Least Squares Line Coefficients

$$b_1 = \frac{s_{xy}}{s_x^2}$$

$$b_0 = \bar{y} - b_1\bar{x}$$

where

$$s_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{n - 1}$$

$$s_x^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n - 1}$$

$$\bar{x} = \frac{\sum_{i=1}^{n}x_i}{n}$$

$$\bar{y} = \frac{\sum_{i=1}^{n}y_i}{n}$$

Shortcut Formula for b_1

$$b_1 = \frac{s_{xy}}{s_x^2}$$

$$s_{xy} = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i y_i - \frac{\sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n}\right]$$

$$s_x^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n}\right]$$

Bijlage 16.3

Shortcut Calculation of SSE

$$\text{SSE} = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2 = (n-1)\left(s_y^2 - \frac{s_{xy}^2}{s_x^2}\right)$$

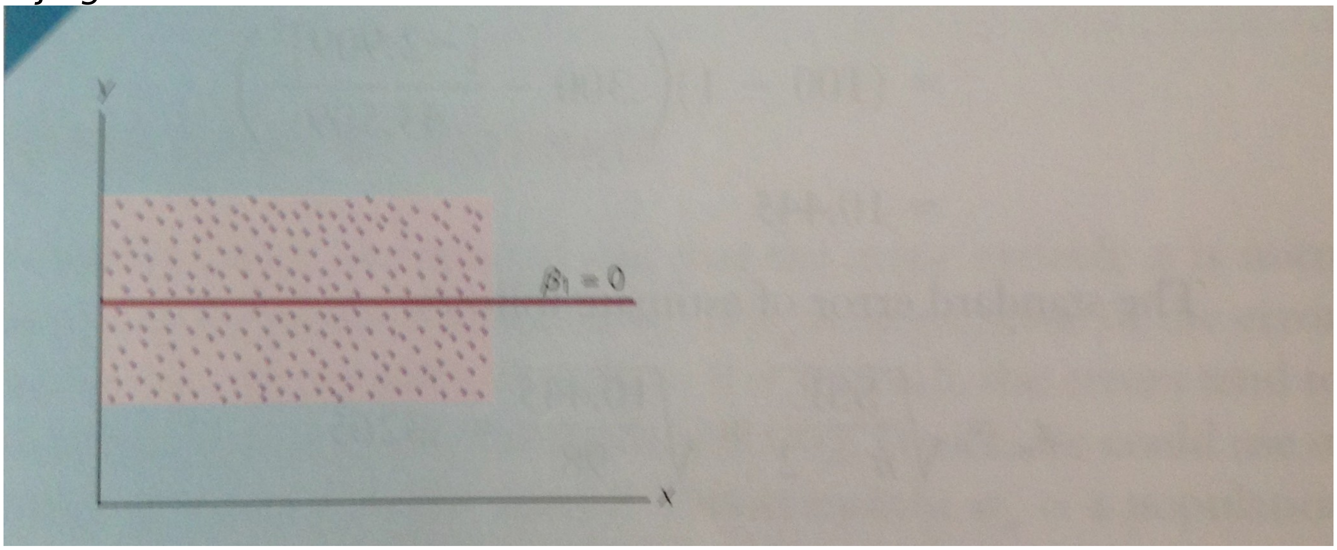
where s_y^2 is the sample variance of the dependent variable.

Bijlage 16.4

Standard Error of Estimate

$$s_\varepsilon = \sqrt{\frac{\text{SSE}}{n-2}}$$

Bijlage 16.5



Bijlage 16.6

Coefficient of Determination

$$R^2 = \frac{s_{xy}^2}{s_x^2 s_y^2}$$

With a little algebra, statisticians can show that

$$R^2 = 1 - \frac{\text{SSE}}{\sum(y_i - \bar{y})^2}$$

Bijlage 16.7

Coefficient of Determination

$$R^2 = 1 - \frac{\text{SSE}}{\sum(y_i - \bar{y})^2} = \frac{\sum(y_i - \bar{y})^2 - \text{SSE}}{\sum(y_i - \bar{y})^2} = \frac{\text{Explained variation}}{\text{Variation in } y}$$

Bijlage 16.8

Sample Coefficient of Correlation

$$r = \frac{s_{xy}}{s_x s_y}$$

Bijlage 16.9

Prediction Interval

$$\hat{y} \pm t_{\alpha/2,n-2} s_\varepsilon \sqrt{1 + \frac{1}{n} + \frac{(x_g - \bar{x})^2}{(n-1)s_x^2}}$$

where x_g is the given value of x and $\hat{y} = b_0 + b_1 x_g$

Bijlage 16.10

Confidence Interval Estimator of the Expected Value of *y*

$$\hat{y} \pm t_{\alpha/2,n-2} s_\varepsilon \sqrt{\frac{1}{n} + \frac{(x_g - \bar{x})^2}{(n-1)s_x^2}}$$

Bijlage 16.11

Standard Deviation of the *i*th Residual

$$s_{e_i} = s_\varepsilon \sqrt{1 - h_i}$$

where

$$h_i = \frac{1}{n} + \frac{(x_i - \bar{x})^2}{(n-1)s_x^2}$$