

Problems and Applications

Suppose a random sample of 200 20-year-old men is selected from a population and their heights and weights are recorded. A regression of weight on height yields

$$\widehat{Weight} = -99.41 + 3.94 \times Height, \quad R^2 = 0.81, \quad SER = 10.2$$

where $Weight$ is measured in pounds and $Height$ is measured in inches.

- What is the regression's weight prediction for someone who is 70 in. tall? 65 in. tall? 74 in. tall?
- A man has a late growth spurt and grows 1.5 in. over the course of a year. What is the regression's prediction for the increase in this man's weight?
- Suppose that instead of measuring weight and height in pounds and inches, these variables are measured in centimeters and kilograms. What are the regression estimates from this new kilogram–centimeter regression? (Give all results, estimated coefficients, R^2 , and SER .)

Weight & Height

$$\widehat{Weight} = -99.41 + 3.94 \times Height, \quad R^2 = 0.81, \quad SER = 10.2$$

- What is the regression's weight prediction for someone who is 70 in. tall? 65 in. tall? 74 in. tall?

$$\widehat{Weight}_{|Height=70} = -99.41 + 3.94 \times 70 = 176.39 \text{ pounds}$$

$$\widehat{Weight}_{|Height=65} = -99.41 + 3.94 \times 65 = 156.69 \text{ pounds}$$

$$\widehat{Weight}_{|Height=74} = -99.41 + 3.94 \times 74 = 192.15 \text{ pounds}$$

Weight & Height

$$\widehat{Weight} = -99.41 + 3.94 \times Height, \quad R^2 = 0.81, \quad SER = 10.2$$

- A man has a late growth spurt and grows 1.5 in. over the course of a year. What is the regression's prediction for the increase in this man's weight?

$$\widehat{Weight}_{|\Delta Height=1.5} = 3.94 \times 1.5 = 5.91 \text{ pounds}$$

Weight & Height

$$\widehat{Weight} = -99.41 + 3.94 \times Height, \quad R^2 = 0.81, \quad SER = 10.2$$

- Suppose that instead of measuring weight and height in pounds and inches, these variables are measured in centimeters and kilograms. What are the regression estimates from this new kilogram–centimeter regression? (Give all results, estimated coefficients, R^2 , and SER .)

In the original units, the intercept coefficient, β_0 , is measured in the same unit as the dependent variable — pounds. The slope coefficient, β_0 , is measured in pounds per inch. The coefficient of determination, R^2 , is a ratio of sums of squares measured in pounds-squared and is therefore unit free. The standard error of the regression, SER , is measured in the same unit as the dependent variable — pounds.

Suppose now that weight is measured in kilogram (kg) and height in centimeter (cm). We have: The intercept coefficient, β_0 , is measured in kilograms. The slope coefficient, β_0 , is measured in kilograms per centimeter. The coefficient of determination, R^2 , is unit free. The standard error of the regression, SER , is measured in kilograms.

Weight & Height

$$\widehat{Weight} = -99.41 + 3.94 \times Height, \quad R^2 = 0.81, \quad SER = 10.2$$

- c. Suppose that instead of measuring weight and height in pounds and inches, these variables are measured in centimeters and kilograms. What are the regression estimates from this new kilogram–centimeter regression? (Give all results, estimated coefficients, R^2 , and SER .)

The in/cm and lb/kg correspondence is:

$$1\text{in} = 2.54\text{cm}$$

$$1\text{lb} = 0.453592\text{kg}$$

The regression becomes:

$$\begin{aligned}\widehat{Weight} &= -99.41 \times 0.453592 + 3.94 \times 0.453592 / 2.54 \times Height, \\ R^2 &= 0.81, \quad SER = 10.2 \times 0.453592\end{aligned}$$

$$\widehat{Weight} = -45.09 + 0.70 \times Height, \quad R^2 = 0.81, \quad SER = 4.6$$