

Exercise 7A.1

Linear regression was used to investigate the relationship between age (years) and systolic blood pressure (mmHg) in a sample of adults ranging from 29 to 69 years old. Stata output is on the next page.

- (a) Write the estimated regression equation.

$$\widehat{SBP} = 97.08 + 0.949 \times AGE$$

- (b) Interpret the estimated intercept. Is this a meaningful quantity?

$$\hat{\beta}_0 = 97.08$$

We estimate that the mean SBP for a person who is 0 years old (a newborn) is 97.08 mmHg.

While it is reasonable to have an SBP estimate for someone who is 0 years old, that is way outside the age range of our data, and so would not be a good estimate.

- (c) Interpret the estimated slope.

$$\hat{\beta}_1 = 0.949$$

We estimate that the mean change in SBP for a 1 year increase in age is 0.949 mmHg.

- (d) What is the estimated mean SBP for a person who is 40 years old?

$$\widehat{SBP} = 97.08 + 0.949 \times AGE = 97.08 + 0.949 \times 40 = 135.0 \text{ mmHg}$$

- (e) What is the estimated change in SBP for 10 year increase in age?

$$0.949 \times 10 = 9.49 \text{ mmHg}$$

- (f) What is the estimated change in SBP for 5 year decrease in age?

$$0.949 \times -5 = -4.745 \text{ mmHg}$$

Output for problem on previous page:

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. regress sbp age
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Source	SS	df	MS	Number of obs	=	29
Model	6110.10173	1	6110.10173	F(1, 27)	=	66.81
Residual	2469.34654	27	91.4572794	Prob > F	=	0.0000
Total	8579.44828	28	306.408867	R-squared	=	0.7122
				Adj R-squared	=	0.7015
				Root MSE	=	9.5633

sbp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
age	.9493225	.1161445	8.17	0.000	.7110137 1.187631
_cons	97.07708	5.527552	17.56	0.000	85.73549 108.4187

Exercise 7A.2

In a study of factors associated with levels of HDL, the “good cholesterol”, investigators were interested in whether or not a person’s education level might be a predictor of HDL (mg/dL). Education was measured as the number of years of education a person had. The researchers used linear regression and obtained the output on the next page. Use this to answer the questions below.

- (a) Write the estimated regression equation.

$$\widehat{HDL} = 52.34 - 0.03225 \times EDUCATION$$

- (b) Interpret the estimated intercept. Is this a meaningful quantity?

$$\hat{\beta}_0 = 52.34$$

We estimate that the mean HDL for a person with 0 years education is 52.34 mg/dL.

Yes, this is meaningful. Someone could have 0 years of education, and in the sample there was at least one person who had this value (notice that the minimum value of education is 0).

- (c) Interpret the estimated slope.

$$\hat{\beta}_1 = -0.03225$$

We estimate that the mean change in HDL for a 1 year increase in education is -0.03225 mg/dL. In other words, each year increase in age is associated with a decrease in HDL of 0.03225 mg/dL.

- (d) What is the estimated mean HDL for a person with the average years of education that was observed in the sample?

Mean of education in the sample = 10.74725

$$\begin{aligned}\widehat{HDL} &= 52.34 - 0.03225 \times EDUCATION = 52.34 - 0.03225 \times 10.74725 = 51.99 \\ &\text{mg/dL}\end{aligned}$$

- (e) What is the estimated difference in mean HDL for people with 12 years of education compared to people with 16 years of education? Make sure to indicate the direction of the difference (which is higher).

$$12 \text{ vs. } 16 \text{ years: } -0.03225 \times (12 - 16) = -0.03225 \times -4 = 0.129 \text{ mg/dL}$$

The estimated mean for people with 12 years education is 0.129 mg/dL HIGHER than for people with 16 years education.

Output for problem on previous page.

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. summarize hdl education
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Variable	Obs	Mean	Std. Dev.	Min	Max
hdl	91	51.98901	15.86645	14	101
education	91	10.74725	4.03483	0	17


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. regress hdl education
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Source	SS	df	MS	Number of obs	=	91
Model	1.52391634	1	1.52391634	F(1, 89)	=	0.01
Residual	22655.4651	89	254.555788	Prob > F	=	0.9385
				R-squared	=	0.0001
				Adj R-squared	=	-0.0112
Total	22656.989	90	251.744322	Root MSE	=	15.955

hdl	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
education	-.0322503	.4168166	-0.08	0.939	-.860456 .7959553
_cons	52.33561	4.781676	10.95	0.000	42.83452 61.8367

