FINM3123 Introduction to Econometrics

Chapter 2 Exercises

Solutions

1.

i) Let $y_i = GPA_i$, $x_i = ACT_i$, and $n = 8$. Then $\bar{x} = 25.875$, $\bar{y} = 3.2125$, $\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) = 5.8125$, and $\sum_{i=1}^{n}(x_i - \bar{x})^2 = 56.875$. From equation (2.19), we obtain the slope as $\hat{\beta}_1 = 5.8125/56.875 \approx .1022$, rounded to four places after the decimal. Then, $\hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x} \approx 3.2125 - (.1022)25.875 \approx .5681$. So we can write

$$\widehat{GPA} = .5681 + .1022\, ACT$$

$$n = 8.$$

The intercept does not have a useful interpretation because *ACT* is not close to zero for the population of interest. If *ACT* is 5 points higher, $\widehat{GPA}$ increases by .1022(5) = .511.

ii) The fitted values and residuals — rounded to four decimal places — are given along with the observation number *i* and *GPA* in the following table:

i	GPA	$\widehat{GPA}$	$\hat{u}$
1	2.8	2.7143	.0857
2	3.4	3.0209	.3791
3	3.0	3.2253	–.2253
4	3.5	3.3275	.1725
5	3.6	3.5319	.0681
6	3.0	3.1231	–.1231
7	2.7	3.1231	–.4231
8	3.7	3.6341	.0659

You can verify that the residuals, as reported in the table, sum to −.0002, which is pretty close to zero given the inherent rounding error.

iii) When $ACT = 20$, $\widehat{GPA} = .5681 + .1022(20) \approx 2.61$.

iv) The sum of squared residuals, $\sum_{i=1}^{n} \hat{u}_i^2$, is about .4347 (rounded to four decimal places), and the total sum of squares, $\sum_{i=1}^{n} (y_i - \bar{y})^2$, is about 1.0288. So the R-squared from the regression is

$$R^2 = 1 - \text{SSR/SST} \approx 1 - (.4347/1.0288) \approx .577.$$

Therefore, about 57.7% of the variation in *GPA* is explained by *ACT* in this small sample of students.

2.

(i) Average salary is about 865.864, which means \$865,864 because *salary* is in thousands of dollars. Average *ceoten* is about 7.95.

(ii) There are five CEOs with *ceoten* = 0. The longest tenure is 37 years.

(iii) The estimated equation is

$$\log(\widehat{salary}) = 6.51 + .0097\ ceoten$$

$$n = 177, \quad R^2 = .013.$$

We obtain the approximate percentage change in *salary* given Δ*ceoten* = 1 by multiplying the coefficient on *ceoten* by 100, 100(.0097) = .97%. Therefore, one more year as CEO is predicted to increase salary by almost 1%.

3. (i) The estimated equation is

$$\widehat{sleep} = 3{,}586.4 - .151\ totwrk$$

$$n = 706, \quad R^2 = .103.$$

The intercept implies that the estimated amount of sleep per week for someone who does not work is 3,586.4 minutes, or about 59.77 hours. This comes to about 8.5 hours per night.

(ii) If someone works two more hours per week then Δ*totwrk* = 120 (because *totwrk* is measured in minutes), and so $\Delta\widehat{sleep}$ = –.151(120) = –18.12 minutes. This is only a few minutes a night. If someone were to work one more hour on each of five working days, $\Delta\widehat{sleep}$ = –.151(300) = –45.3 minutes, or about five minutes a night.