Introduction to Econometrics (3rd Updated Edition)

by

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Solutions to Odd-Numbered End-of-Chapter Exercises: Chapter 7

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7.1

Regressor	**(1)**	**(2)**	**(3)**
College (X_1)	8.31** (0.23)	8.32** (0.22)	8.34** (0.22)
Female (X_2)	–3.85** (0.23)	–3.81** (0.22)	–3.80** (0.22)
Age (X_3)		0.51** (0.04)	0.52** (0.04)
Northeast (X_4)			0.18 (0.36)
Midwest (X_5)			–1.23** (0.31)
South (X_6)			–0.43 (0.30)
Intercept	17.02** (0.17)	1.87 (1.18)	2.05* (1.18)

7.3. (a) Yes, age is an important determinant of earnings. Using a *t*-test, the *t*-statistic is $0.51/0.04 = 12.8$, with a *p*-value less than .01, implying that the coefficient on age is statistically significant at the 1% level. The 95% confidence interval is $0.51 \pm (1.96 \times 0.04)$.

(b) $\Delta Age \times [0.51 \pm 1.96 \times 0.04] = 5 \times [0.51 \pm 1.96 \times 0.04] = 2.55 \pm 1.96 \times 0.20 =$ \$2.16 to \$2.94

7.5. The *t*-statistic for the difference in the college coefficients is

$$t = (\hat{\beta}_{college,2012} - \hat{\beta}_{college,1992})/SE(\hat{\beta}_{college,2012} - \hat{\beta}_{college,1992}).$$

Because $\hat{\beta}_{college,2012}$ and $\hat{\beta}_{college,1992}$ are computed from independent samples, they are independent, which means that $\text{cov}(\hat{\beta}_{college,2012}, \hat{\beta}_{college,1992}) = 0$.

Thus, $\text{var}(\hat{\beta}_{college,2012} - \hat{\beta}_{college,1992}) = \text{var}(\hat{\beta}_{college,2012}) + \text{var}(\hat{\beta}_{college,1998})$.

This implies that $SE(\hat{\beta}_{college,2012} - \hat{\beta}_{college,1992}) = (0.22^2 + 0.33^2)^{\frac{1}{2}} = 0.40$.

Thus, the *t*-statistic is (8.32 − 8.66)/0.40 = –0.85. The estimated change is not statistically significant at the 5% significance level (0.85 < 1.96).

7.7. (a) The t-statistic is $\frac{0.485}{2.61} = 0.186 < 1.96$. Therefore, the coefficient on BDR is not statistically significantly different from zero.

(b) The coefficient on *BDR* measures the *partial effect* of the number of bedrooms holding house size (*Hsize*) constant. Yet, the typical 5-bedroom house is much larger than the typical
2-bedroom house. Thus, the results in (a) says little about the conventional wisdom.

(c) The 99% confidence interval for effect of lot size on price is $2000 \times [.002 \pm 2.58 \times .00048]$ or 1.52 to 6.48 (in thousands of dollars).

(d) Choosing the scale of the variables should be done to make the regression results easy to read and to interpret. If the lot size were measured in thousands of square feet, the estimate coefficient would be 2 instead of 0.002.

(e) The 10% critical value from the $F_{2,\infty}$ distribution is 2.30. Because $0.08 < 2.30$, the coefficients are not jointly significant at the 10% level.

7.9. (a) Estimate

$$Y_i = \beta_0 + \gamma X_{1i} + \beta_2 (X_{1i} + X_{2i}) + u_i$$

and test whether $\gamma = 0$.

(b) Estimate

$$Y_i = \beta_0 + \gamma X_{1i} + \beta_2 (X_{2i} - aX_{1i}) + u_i$$

and test whether $\gamma = 0$.

(c) Estimate

$$Y_i - X_{1i} = \beta_0 + \gamma X_{1i} + \beta_2 (X_{2i} - X_{1i}) + u_i$$

and test whether $\gamma = 0$.

7.11. (a) Treatment (assignment to small classes) was not randomly assigned in the population (the continuing and newly-enrolled students) because of the difference in the proportion of treated continuing and newly-enrolled students. Thus, the treatment indicator X_1 is correlated with X_2. If newly-enrolled students perform systematicallydifferently on standardized tests than continuing students (perhaps because of adjustment to a new school), then this becomes part of the error term u in (a). This leads to correlation between X_1 and u, so that $E(u|X_1) \neq 0$. Because $E(u|X_1) \neq 0$, the $\hat{\beta}_1$ is biased and inconsistent.

(b) Because treatment was randomly assigned conditional on enrollment status (continuing or newly-enrolled), $E(u|X_1, X_2)$ will not depend on X_1. This means that the assumption of conditional mean independence is satisfied, and $\hat{\beta}_1$ is unbiased and consistent. However, because X_2 was not randomly assigned (newly-enrolled students may, on average, have attributes other than being newly enrolled that affect test scores), $E(u|X_1, X_2)$ may depend of X_2, so that $\hat{\beta}_2$ may be biased and inconsistent.