Confidence Intervals: Earnings

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Textbook:

James H. Stock and Mark W. Watson, *Introduction to Econometrics*, 4th Edition, Pearson.

Other references:

Joshua D. Angrist and Jörn-Steffen Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, 1st Edition, Princeton University Press.

Jeffrey M. Wooldridge, *Introductory Econometrics: A Modern Approach*, 7th Edition, Cengage Learning.

The textbook comes with online resources and study guides. Other references will be given from time to time.

Dependent variable: average hourly earnings (*AHE*).

Regressor	(1)	(2)	(3)
College (X_1)	10.47 (0.29)	10.44 (0.29)	10.42 (0.29)
Female (X_2)	−4.69 (0.29)	−4.56 (0.29)	−4.57 (0.29)
Age (X_3)		0.61 (0.05)	0.61 (0.05)
Northeast (X_4)			0.74 (0.47)
Midwest (X_5)			−1.54 (0.40)
South (X_6)			−0.44 (0.37)
Intercept	18.15 (0.19)	0.11 (1.46)	0.33 (1.47)
Summary Statistics and Joint Tests			
F-statistic testing regional effects $= 0$			9.32
SER	12.15	12.03	12.01
R^2	0.165	0.182	0.185
n	7178	7178	7178

Problems and Applications

Stock & Watson, Introduction (4th), Chapter 7, Exercise 5.

The regression shown in column (2) was estimated again, this time using data from 1992 (4000 observations selected at random from the March 1993 Current Population Survey, converted into 2015 dollars using the Consumer Price Index). The results are

$$\begin{aligned} \widehat{AHE} = &- \underset{(1.65)}{1.3} + \underset{(0.34)}{8.94}\ College - \underset{(0.30)}{4.38}\ Female + \underset{(0.05)}{0.67}\ Age, \\ &\bar{R}^2 = 0.21, \quad SER = 9.88 \end{aligned}$$

Comparing this regression to the regression for 2015 shown in column (2), was there a statistically significant change in the coefficient on College?

Problems and Applications

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The t-statistic for the difference in the college coefficients is:

$$t = \frac{\hat{\beta}_{\text{College, 2015}} - \hat{\beta}_{\text{College, 1992}}}{\text{SE}(\hat{\beta}_{\text{College, 2015}} - \hat{\beta}_{\text{College, 1992}})}$$

Since the samples are independent,

$$\begin{aligned} & \text{cov}(\hat{\beta}_{\text{College, 2015}}, \hat{\beta}_{\text{College, 1992}}) = 0 \\ \implies \text{var}(\hat{\beta}_{\text{College, 2015}} - \hat{\beta}_{\text{College, 1992}}) &= \text{var}(\hat{\beta}_{\text{College, 2015}}) + \text{var}(\hat{\beta}_{\text{College, 1992}}) \\ &= (0.29)^2 + (0.34)^2 \\ &= 0.1997 \end{aligned}$$

Problems and Applications

Comparing this regression to the regression for 2015 shown in column (2), was there a statistically significant change in the coefficient on College?

The standard error is the square-root of the variance of the difference:

$$\text{SE}(\hat{\beta}_{\text{College, 2015}} - \hat{\beta}_{\text{College, 1992}}) = \sqrt{0.1997} \approx 0.447$$

The associated t-statistic is:

$$t = \frac{10.44 - 8.94}{\sqrt{0.1997}} \approx \frac{1.5}{0.447} \approx 3.36 > 1.96$$

Since the test statistic is greater than 1.96, the hypothesis that there was no change in the population coefficient on $College$ can be rejected at the 5% level — there was a statistically significant change in the coefficient between 1992 and 2015.