Lab 5: Endogeneity and hypothesis testing

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Summary[1]

Hypothesis testing

In economics, we usually want to test whether our estimates are significantly different from zero. In other words, the null hypothesis is $H_o : \hat{\beta} = 0$. We use t-statistics to assess our results. Two steps:

1. Calculate the t-statistic of your estimate (Often, $\beta_{null} = 0$)

$$t = \frac{\hat{\beta} - \beta_{null}}{SE(\hat{\beta})}$$

2. Then, compare the t-statistic you calculated to the critical value. The table below displays the critical value for each confidence level:

Level	Critical value
1%	2.58
5%	1.96
10%	1.65

Omitted variables

You decide to run this regression:	$Salary = \beta_0^{omit} + \beta_1^{omit} X_1 + u$
You forgot to include X_2:	$Salary = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$
The relation between X_1 and X_2 is:	$X_1 = \alpha + \delta X_2 + \epsilon$

Omitting a relevant variable will cause your estimates to be biased. The direction of the bias will be determined by the following formula

$$\beta_1^{omit} = \beta_1 + \beta_2 \delta$$

Measurement error

This happens when the observed value of a variable and the actual value of a variable differ. Suppose that instead of observing X_1^* you observe $X_1 = X_1^* + \eta$. Then your bias (which in this context is called attenuation bias) is the following:

$$plim \hat{\beta}_1 = \beta \frac{\sigma_{X_1^*}^2}{\sigma_{X_1^*}^2 + \sigma_\eta^2}$$

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[1]Key terms are paraphrased or copied from Real Econometrics by Michael A. Bailey or from the class lectures by Joe Ritter

In-class activity

1. T-tests

2. Omitted variables exercise

Omitted variable	β_2	δ	Direction $(\beta_2\delta)$	$\hat{\beta}_1$
Female				
Spouse works				
Education				
Weather				

3. Review the concepts

- What are the two conditions for an omitted variable to cause bias?
- When does measurement error cause bias?
- What is collinearity?