# Midterm Review

## EC 320: Introduction to Econometrics

Winter 2022

# Prologue

# Housekeeping

Problem Set 3

- Due tonight by 23:59 on Canvas

Midterm 2 on Wednesday

- **No lab this week**

# Midterm II: The Weeds

# Midterm Topics

Anything from the lectures, labs, or problem sets **is fair game!**

1. Simple Linear Regression: Estimation I & II
2. Classical Assumptions
3. Simple Linear Regression: Inference
4. Multiple Linear Regression: Estimation
5. Multiple Linear Regression: Inference
6. Regressions in R

# Midterm Topics

## 1. Simple Linear Regression: Estimation

OLS mechanics

- How does OLS pick parameter estimates?
- What properties are a direct consequence of OLS?
- Residuals *v.s.* errors

Coefficient interpretation

# Midterm Topics

## 1. Simple Linear Regression: Estimation (cont.)

Goodness of fit

- $R^2$ interpretation
- Understand $R^2$ derivation
- Use and misuse of $R^2$

OLS by hand

- Estimate coefficients and calculate $R^2$.

# Midterm Topics

## 2. Classical Assumptions

Six assumptions

1. Linearity
2. Sample variation/no perfect collinearity
3. Exogeneity
4. Homoskedasticity
5. Non-autocorrelation
6. Normality

What do they buy?

When are they satisfied? When are they violated?

# Midterm Topics

## 2. Classical Assumptions (cont.)

**So what?**

- Coefficient interpretation
- Hypothesis test validity

# Midterm Topics

## 3. Simple Linear Regression: Inference

Making inferences about population parameters

- Population *v.s.* sample

Hypothesis testing (*e.g.*, *t* tests)

- Null hypotheses *v.s.* alternative hypotheses
- Left-tailed, right-tailed, and two-tailed
- Type I *v.s.* Type II error

Confidence intervals

# Midterm Topics

## 4. Multiple Linear Regression: Estimation

OLS mechanics and properties

Goodness of fit

- $R^2$ interpretation
- Know the behavior of $R^2$ as the number of explanatory variables increases.

Make predictions for certain values of the explanatory values (*e.g.,* hedonic modeling)

# Midterm Topics

## 4. Multiple Linear Regression: Estimation (cont.)

Coefficient interpretation

Omitted-variable bias

- Know when omitting a variable causes bias.
- Sign the bias.
- Back out correlations between explanatory variables.

# Midterm Topics

## 5. Multiple Linear Regression: Inference

Confidence intervals and *t* tests

- Other than degrees of freedom, same as before.

Multicollinearity

- Standard errors depend on the overlapping variation between the explanatory variable.
- More overlap $\implies$ bigger standard errors $\implies$ less likely to reject null hypothesis.

Irrelevant variables

**No *F* tests on the midterm!** Stay tuned for the final.

# Midterm Topics

## 6. Regressions in R

Write the code that generates regression output

- I provide the console or R Markdown output and the name of the data file.
- You provide the code that loads the necessary packages, imports the data, runs regressions, and generates a table.
- Write the code as if it's in a `.R` script.

# Midterm Structure

## Fill in the Blank

- 10 blanks
- 3 points per blank (30 points total)

## True or False

- 5 questions
- 6 points per question (30 points total)

## Free Response

- 5 multi-part questions with varying numbers of points (50 points total)
- Explanations required for full credit

# Midterm Protocol

## Materials

- Writing utensil
- 3-inch-by-5-inch note card
- Basic or scientific calculator (no graphing or programming capabilities)
- **Nothing else**

## Procedure

- 80 minutes from *"you may begin"* to *"pencils down"*
- First 30 minutes: **quiet period** (no questions, no getting up)
- Last 50 minutes: ask lots of questions

# Practice

# Regression Table

## Example

Suppose we have the following fitted model for wage equation (standard errors in parenthesis, n=500):

$$\widehat{\text{Earnings}} = \underset{}{-11.65} + \underset{(0.211)}{1.77\ \text{S}} + \underset{(0.206)}{0.65\ \text{EXP}}$$

$t_{0.975}(497) = 1.96$ and $t_{0.95}(497) = 1.65$

1. Interpret the regression results
2. Perform two-tailed 5-percent test of the null hypothesis that schooling has no effect on hourly earnings.
3. Perform one-tailed 5-percent test of the null hypothesis that experience has no effect on earnings against the alternative hypothesis that experience has a positive effect on earnings.
4. Confidence interval