EC 320: Introduction to Econometrics
Lecture Notes

David M. Hall
University of Oregon

Fall 2025

Overview:

The following sheet should provide you some understanding of:

- What we have learned thus far in this course.
- What I expect you to understand well by the midterm.
- What types of questions you can expect to answer on the midterm exam.

The purpose of doing this assignment is to give you a general outline of how we got to this point in the course — that is, how we got to our current understanding of multiple linear regression. In doing this assignment, I also hope to give you just one more study tool as well as a resource you can look back on when you take EC421 and beyond. I will note that some of what is on this is helpful to this day as I work on my research.

When I say "define", while I mean write out the equation, I also expect you to have an intuitive understanding such that you would be able to write, *in words*, what that word(s) mean.

Review:

1. Take expectations of a random variable.
    - Take expectations of *functions of* random variables.
    - Use expected value rules.
2. Define the population variance (expectations formula).
3. Define the population covariance (expectations formula).

1 Chapter 1: Simple Linear Regression Model

1. Write out the "true" simple linear model.
2. Write out the simple linear *regression* model.
3. Define the residual of the simple linear model.
4. Define the residual sum of squares (RSS) of the simple linear model.
5. Use the RSS to solve for $\hat{\beta}_0$.
6. Use the RSS to solve for $\hat{\beta}_1$.
7. Given 3-5 data points, calculate (numerically) $\hat{\beta}_0$ and $\hat{\beta}_1$.
8. Properly interpret the intercept and coefficient of the simple linear regression model.
9. Define total sum of squares (TSS).
10. Define explained sum of squares (ESS).
11. Recall what the mean of the residual is.
12. Recall the residual orthogonality theorem.
13. Define R^2.
14. Understand the connection between R^2, TSS, ESS and RSS.

2 Chapter 2: OLS Assumptions and BLUE

1. Given one of the six OLS assumptions, decide if a statement breaks the assumption.
2. Explain each of the six OLS assumptions in words.
3. Given the OLS estimator as a function of the true parameter and some random error, show that OLS is unbiased.
4. Derive and define the OLS standard error.
5. Given an expected true model and an estimator, show that the estimator is unbiased.
6. Calculate a t-statistic from a coefficient and a standard error.
7. Carry out a hypothesis test using t-statistics.
8. Given a t-statistic, obtain a p-value.
9. Given a p-value, carry out a hypothesis test.
10. Carry out an F test for overall goodness of fit.

3 Chapter 3: Multiple Regression

1. *Understand* how one would obtain the OLS estimator in the multiple linear context.
2. Given one of the six OLS assumptions, decide if a statement breaks the assumption.
3. Explain each of the six OLS assumptions in words.
4. Compare and contrast the six OLS assumptions between the simple and multiple regression context.
5. Do all the same hypothesis testing for the simple case.
    - Calculate a t-statistic from a coefficient and a standard error.
    - Carry out a hypothesis test using t-statistics.
    - Given a t-statistic, obtain a p-value.
    - Given a p-value, carry out a hypothesis test.
    - Carry out an F test for overall goodness of fit.
    - **Additionally:** carry out an F test for the marginal inclusion of variables.