AEREC 510: ECONOMETRICS I
Fall 2019

Monday & Wednesday	Friday (Comp. Lab)
202 Ferguson	105 Ferguson
10:10 - 11:00 am	10:10 - 11:00 am

Instructor

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Office Hours: Monday and Thursdays, 3:00 to 4:00pm, by appointment

Introduction:

Econometrics is concerned with using aspects of economic theory, mathematics and statistical inference to analyze economic phenomena and relationships. This course approaches econometrics with three broad considerations:

1. The role of econometrics in theoretical and applied economics
2. The theoretical basis of econometrics
3. The applied use of econometrics.

The course will involve lectures on Mondays, Wednesdays and Fridays. Friday's session will be held in a computer lab where students can participate in hands-on implementation of the lecture material using STATA econometric software.

Prerequisites: Multivariate calculus, matrix algebra, introduction to probability theory, statistical inference, and an introduction to the multiple linear regression model.

(If needed, a review session for Matrix Algebra can be held outside of class time early in the semester at a time convenient to all.)

Course Requirements: Grades for the course will be based on:

• Three Midterm examinations	36% total (12% each)
• Final exam	24%
• Problem sets (4 total)	25% total (6.25% each)
• In-class lab exercises (12 total)	15% total
	100%

Course Materials and Resources:

- The required text for the course is Greene, W., *Econometric Analysis*, 7th Edition, Prentice Hall, 2011.
    - The most recent edition is the 8th, but **any edition should be okay**. Section headings below are for the 7th edition.
- Other useful texts:
    - Hayashi, F., *Econometrics*, Princeton Univ. Press, 2000. (similar level as Greene and very readable.)
    - Intriligator, M.D., R.G. Bodkin, and C. Hsiao, *Econometric Models, Techniques, and Applications*, 2nd ed., Prentice Hall, 1996. (lower level than Greene and very readable)
- Class materials (lecture notes, lab assignments, problem sets, etc.) will be on Canvas
- Hand-written problem sets can be submitted by hand; electronic version can be emailed.
- Completed lab "log" files should be submitted via Canvas by Monday, 11:59pm, following each Friday's lab.

Math Stats

- I will not cover math stats except for a one-week review. However, I will post four weeks of lecture notes from past years' classes. Recommended but not required is Hogg, R.V., McKean, and J.W.Craig, A., *Introduction to Mathematical Statistics*, 7th Edition, Prentice Hall Publishers.

Software: On Friday's we will meet in a computer lab. Data sets and in-class labs will be conducted using STATA econometric software. The data sets used for the examples will be available on the Canvas course website.

Academic Integrity:

Academic dishonesty includes, but is not limited to: cheating, plagiarizing, fabricating of information or citations, facilitating academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of others. Sanctions imposed for acts of academic dishonesty can include receiving an "F" for the assignment, course, or even expulsion from the University. All course participants are expected to adhere to the University's Academic Integrity Policy http://www.psu.edu/ufs/policies/47-00.html#49-20. In addition, the instructor will complete a College of Agricultural Sciences Academic Integrity Form and file it with the Associate Dean for Undergraduate Education.

AEREC 510 Econometrics I: Course Outline (subject to change)

0. Review of Math Stats (One week only!)

Pdfs, Cdfs, 10 "expectation results, 10 distribution results
Hogg, McKean & Craig 1.5 – 1.9; 2.1-2.6, 2.8; 3.3 – 3.6; 5.3; 6.1 – 6.3.

I. The Classical Linear Regression Model: Specification & Computation

A. The classical linear regression model and its functional form
   a. The linear regression model [Greene 2.2]
   b. Six assumptions of the linear model [Greene 2.3]
B. Least squares [Greene Ch. 3]
   a. Least squares regression [Greene 3.1-3.2]
   b. Partitioned regression and the Frisch-Waugh theorem [Greene 3.3]
C. Evaluating the fit of the regression, R^2, Adjusted R^2 [Greene 3.5 – 3.6]
D. Least squares with restrictions [Greene 5.3 and 5.5.1]

(In-class Exam #1)

II. The Classical Linear Regression Model: Statistical Properties and Building Models

A. Statistical properties of the least squares estimator in finite samples [Greene 4.1-4.5]
   a. Motivating least squares [Greene 4.2]
   b. Finite sample properties of LS [Greene 4.3]
      i. Expectation
      ii. Omitted and superfluous variables
      iii. Gauss-Markov theorem
      iv. Variance of the least squares estimator
B. Estimating the variance of the least squares estimator
   a. Conventional estimation [Greene 4.6]
   b. Multicollinearity [Greene 4.8]
C. The Normality Assumption the Relationship to Maximum Likelihood Estimation Greene 4.4.6]
D. Large Sample Properties of the LS Estimator [Greene 4.4]
      i. Consistency
      ii. Assymptotic Normality of **b**
      iii. Consistency of s^2
E. Confidence Intervals [Greene 4.5]
F. Data Problems – Multicolinearity [Greene 4.7.1]
G. Hypothesis Tests [Greene 5.2, 5.4, 5.5]
H. Binary Variables [Greene 6.2]
I. Testing a Structural Break [Greene 6.4]

(In-class Exam #2)

III. Generalized Regression Model

A. Nonspherical disturbances [Greene 9.1 and 9.2]
B. Implications For LS and Feasible Generalized Least Squares [Greene 9.3]
C. Heteroscedasticity [Greene 9.4]
    a. Testing for Heteroscedasticity [Greene 9.5]
    b. Weighted Least Squares and Applications [Greene 9.6 and 9.7]
D. First-Order Serial Correlation and Tests [Greene 20.1, 20.3, 20.5, 20.7-20.9]

IV. Instrumental Variables Estimation

A. Intro and model assumptions [Greene 12.1 and 12.2]
B. Estimation
    a. IV estimator [Greene 12.3.2]
    b. Two-stage least squares [Greene 12.3.3]
    c. Statistical tests [Greene 12.4 and 12.9]

(Take-home Exam #3)

V. Maximum Likelihood Estimation and Discrete-Choice Models

A. Point Estimation with MLE [Greene 16.2 and 16.3]
B. Properties of MLE [Greene 16.4]
C. Conditional likelihoods for econometric models [Greene 16.5]
D. MLE for binary choice models – Probit and Logit [Greene 23.1-23.4]
E. Multinomial, Conditional, and Mixed Logit for Unordered Multiple Choices [Greene 23.11]

(Final Exam – heavily weighted to parts IV and V)