

# **AEREC 510: ECONOMETRICS I**

Fall 2007

Monday & Wednesday  
218 Thomas  
2:30 - 3:20 pm

Friday (Lab)  
006 Life Sciences  
2:30 – 3: 20 pm

## **Instructor:**

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## **Teaching Assistant**

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## **Office Hours:**

To be announced.

## **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 and Wednesdays and an econometrics laboratory session on Fridays. The lab sessions will focus on computational implementation of the lecture material.

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

(A review session for Matrix Algebra will 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 (15% each)
- Final exam (25%)
- Several problem sets and small projects (total 30%).

**Course Materials:**

- The required text for the course is Greene, W., *Econometric Analysis*, 6<sup>th</sup> Edition, Prentice Hall, 2007.
- Hogg, R.V., Craig, A., and McKean, J.W., *Introduction to Mathematical Statistics*, Prentice Hall Publishers. The most recent edition (6th edition) is fine but expensive. Earlier editions such as the 4th and 5th are entirely acceptable (and much cheaper!!)

**Software:** Some of the outside work for this course will involve using a computer. Students may use any computer software that they are familiar with for this purpose. Data sets needed for some of the exercises will be distributed to the class via the course website. The data sets used for the examples in the text are all available at the text website.

## Outline

### I. Review of Probability and the Foundations of Statistical Inference

- A. Probability & Distributions [Hogg, McKean & Craig 1.1 – 1.9]
  - Probability density functions
  - Distribution functions
- B. Multivariate Distributions [Hogg, McKean & Craig 2.1-2.6]
  - Marginal and Conditional Distributions
  - Independent Events
  - Mathematical Expectation
  - Correlation
- C. Some Probability Distributions [Hogg, McKean & Craig 3.3 – 3.6]
  - Distributions Associated with the Normal
- D. Point Estimation [Hogg, McKean & Craig 6.1 – 6.3 & 5.1, 5.4 - 5.5]
  - Maximum Likelihood
  - Properties of Estimators

### *(Midterm Examination #1)*

### II. The Classical Linear Regression Model: Specification & Computation

- A. The classical linear regression model and its functional form
  - a. The linear regression model [Greene 2.1]
  - b. Linear models and intrinsic linearity [Greene 2.1-2.3]
  - c. Logs and levels, estimating elasticities [Greene 2.3.1]
  - d. Functional form and linearity; transformations and dummy variables [Greene 6.1-6.2]
  - e. Linearized regression and Taylor series [Greene 2.3.1, pp. 285-286]
- 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, 3.4]
  - c. Applications of partitioned regression: a fixed effects model [Greene pp. 197-210]
- C. Evaluating the fit of the regression, ANOVA, Adjusted  $R^2$  [Greene 3.4, 3.5, 7.4]
- D. Least squares with restrictions [Greene 5.3.2 - 5.3.3]

*(Midterm Examination #2)*

**III. The Classical Linear Regression Model: Statistical Inference in Finite Samples**

- A. Statistical properties of the least squares estimator in finite samples [Greene 4.1-4.5]
  - a. Why least squares? [Greene 4.2]
  - b. Sampling distributions [Greene Example 4.1]
  - c. Expectation [Greene 4.3]
  - d. Omitted and superfluous variables [Greene 7.2.1, 7.2.3]
  - e. Variance of the least squares estimator [Greene 4.4, 7.2.2]
  - f. Gauss-Markov theorem [Greene 4.4, 4.5]
- B. Estimating the variance of the least squares estimator
  - a. Conventional estimation [Greene 4.6]
  - b. Multicollinearity [Greene 4.9.1]
  - c. Bootstrapping [Greene pp. 596-598]
- C. Sampling distribution of the least squares coefficient vector
  - a. Generalities about sampling
  - b. Sampling distributions and properties of estimators [Greene 4.3-4.5]
  - c. Linear estimator and normality [Greene 4.7]
  - d. Efficient estimation, precision, mean squared error [Greene 4.4, 7.2.2]
  - e. Describing the sampling distribution of the estimator [Greene 4.7]
- D. Statistical Inference in the linear model
  - a. Standard results for testing [Greene 5.1 through 6.3]
  - b. Structural change [Greene 6.4, 6.5]
  - c. Model selection [Greene 7.3, 7.4]
  - d.  $J$  test for non-nested models [Greene 7.3.3]

*(Midterm Examination #3)*

**IV. Generalized Regression Model**

- A. Nonspherical disturbances [Greene 8.1]
    - a. General set up [Greene 8.1]
    - b. Heteroscedasticity [Greene 8.4 – 8.5]
    - c. Autocorrelation [Greene 19.1, 19.2]
  - B. Implications for least squares [Greene 8.4.1, 8.4.3 – 8.4.4, 19.5]
  - C. Generalized least squares and weighted least squares [Greene 8.3, 8.6, 19.8-19.9]
  - D. Generalized least squares estimation [Greene 8.7, 8.8, 19.9]
- V. Topics** (Student choice & time permitting)
- A. Bayesian estimation
  - B. Limited dependent variable models
  - C. Nonparametric regression