

## Econometrics I - Fundamentals

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**Scheduled Class Time and Organization:** Class will meet twice a week *Tuesdays and Thursdays from 1:30-3:00* for lectures in Room 286-7, McNeil. The teaching assistants will conduct a one hour discussion and review session once a week. Details will be announced.

**Course Description:** This is the first econometrics course in the first-year Econ Ph.D. sequence at Penn. The course covers selected topics in mathematical statistics, least squares estimation, large sample analysis of least squares and related estimators, endogeneity, generalized methods of moments (GMM), maximum like-

likelihood estimation of linear and nonlinear models, analysis of panel data models, as well as re-sampling techniques.

**Prerequisites:** Calculus, Linear Algebra, Probability and Statistics

**Course Web Page:** Course documents and information are available via Canvas: <http://courseweb.library.upenn.edu>.

**Course Requirements:**

- **Problem Sets:** There will be 8 problem sets, assigned during the semester (4 for each part). The problem sets are designed to give the students the opportunity to review and enhance the material learned in class. Students are encouraged to form small study groups, however, each student has to submit his or her own write-up of the solution. These solutions must be submitted on the specified due dates. [20%]
- **Midterm Exam:** Thursday, Oct 17. [40%]
- **Final Exam:** Friday, Dec 20, 12:00-2:00p (according to registrar's site) [40%]

**Course text:**

Hayashi, Fumio (2000): "*Econometrics*," Princeton University Press, ISBN 0-691-01018-8, HB139.H39 2000. (highly recommended)

Casella, George and Roger Berger (2001): "*Statistical Inference*," Duxbury Press, ISBN: 9780534243128 (highly recommended)

**Econometrics Software:** The problem sets will involve computer-based exercises in which the econometric techniques introduced in the lectures will be applied. The recommended software for this course is *R*. It is available free of charge at: <http://www.r-project.org/>.

## Econometrics I – Course Outline

### Part I

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Lecture	Topic
1	Least Squares and Projections
2	Probability
3	Expectations and Densities
4, 5	Independence and Conditioning
6	Point Estimation
7, 8	Testing and Confidence Sets
9, 10	Small Sample Inference for Linear Regressions
11	Asymptotics: Modes of Convergence
12	Asymptotics: Large Sample Analysis of Linear Regression Model
13	Asymptotics: Likelihood Function, Wald, LR, and LM Tests

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## Part II

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Lecture	Topic
1	Endogeneity and Instrumental Variable
2	Estimation of Linear Models with Endogeneity
3, 4	Generalized Method of Moments
5, 6	Maximum Likelihood Estimation of Nonlinear Models
7, 8	Extremum Estimator and Asymptotic Theory
9	Test of Nonlinear Restrictions
10, 11	Panel Data
12, 13	Bootstrap

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