



Graduate  
Program  
in Economics

**Course:** Econometrics I  
**Faculty:** Pau Milán  
**Term:** Second semester, year 1  
**E-mail:** pau.milan@gmail.com  
**Web page:** sites.google.com/site/paumilan  
**Office Hours:** Wednesdays, 15-17

**Description:** This is the first half of the required introductory course in econometrics. Prerequisites are a good command of linear algebra, optimization, probability and statistics.

**Objective:** The objective of this course is to familiarize students with the most common statistical methods in econometrics. We will study the linear model, its basic assumptions, and derive the asymptotic properties of some basic estimators (such as OLS, GLS and IV). Students will also acquire a working knowledge of statistical packages (Stata and Matlab)

**Outline:**

1. *Introduction: Review of Statistics*

- a. Estimation theory:
  - Criteria for an estimator: analogy principle
- b. Hypothesis testing:
  - Definition
  - Neyman-Pearson lemma
  - Confidence intervals

2. *The Linear Regression Model*

- a. The Basic Model

- Assumptions
- Algebra of least squares
- Geometry of least squares
- b. Properties of OLS
  - Finite sample distribution
  - Gauss-Markov Theorem
  - Estimation of error variance
- c. Properties Under Normality
  - Assumptions and Properties
  - Exact Tests

### 3. *Large-Sample Theory*

- a. Review of Limit Theorems
  - Modes of convergence
  - Law of large numbers
  - Central limit theorem
- b. Large-Sample Distribution of OLS
  - Consistency
  - Asymptotic Normality
- c. Hypothesis Testing
  - Exact Vs. asymptotic tests
  - The Trinity: Wald, LM, and LR tests
- d. Bootstrap
  - Basic Principle
  - Properties

### 4. *Robust Estimation*

- a. Heteroskedasticity
  - Generalized Least Squares (GLS)
  - White Test
  - Grouped data
- b. Autocorrelation
  - Robust estimation
  - Tests
- c. Collinearity
  - Ridge and Lasso

### 5. *Endogeneity*

- a. Sources of endogeneity
  - Simultaneity
  - Omitted variables
  - Measurement error
- b. Instrumental variables (IV) and 2SLS
  - Orthogonally and relevance restrictions
  - Estimation
- c. Identification
- c. Tests of endogeneity

**References:**

- Lecture Notes (will be made available on my website)
- Hayashi (2001) *Econometrics*, Princeton University Press.
- Wooldridge (2002) *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Cambridge- Mass, USA.

**Other Sources:**

- Cameron and Trivedi, (2005) *Microeconometrics: Methods and Applications*, Cambridge University Press.
- Greene, W.H. (2000) *Econometric Analysis*, Pearson Prentice Hall.

**Grading:**

problem sets (analytic and computational) (20%) and final exam (80%).